Final report

OWMC
Ontario
Waste Management
Corporation

A provincial crown corporation

ONTARIO RESEARCH
FOUNDATION

SITE ASSESSMENT
PHASE 4B:
ATMOSPHERIC CONDITIONS
VOLUME 1 - MAIN REPORT

Prepared for
The Ontario Waste Management Corporation

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October 28, 1987

Mr. J.G. Micak
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Dear Mr. Micak:

We are pleased to submit herewith our report on the detailed air quality assessment of OWMC's proposed waste management facility in the Township of West Lincoln. The report is entitled "Phase 4B Site Assessment: Atmospheric Conditions".

Please note that the report is organized in four volumes. Volume 1 contains the main report with accompanying tables and figures. Appendices A to E are in Volume 2, Appendix F is found in Volume 3 and Appendices G to Q are in Volume 4. The appendices contain details of data, calculations and other supporting information.

Yours very truly,

C J Baynes

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EXECUTIVE SUMMARY

PURPOSE OF THE REPORT

The purpose of this report is to document the potential effects on local air quality of the air emissions from the proposed Ontario Waste Management Corporation (OWMC) waste management facility in the Township of West Lincoln, Regional Municipality of Niagara.

SCOPE AND METHOD

This study addresses the effects of air emissions primarily in terms of the difference between existing or "background" air quality, and the anticipated conditions during construction and during subsequent operation of the proposed facility. Pollutant concentrations in ambient air are predicted and assessed in terms of the potential risk to human health and potential impacts on the environment. In general, in this report the presence or absence of such effects is determined based on the expected degree of compliance with established air quality standards, guidelines and criteria. Only emissions due to construction and normal operation of the facility were addressed. Emissions during de-commissioning were not included in this report, due to the current unavailability of details of the site clean-up plan. The effects of process upsets and accidental emissions were also not included, but are being addressed elsewhere.

To establish the basis for this assessment, the report first presents a review and summary of regulations governing air emissions in

Canada and Ontario. A review is also presented of relevant regulations from other jurisdictions. The assessment then proceeds to a description of the existing air environment of the preferred site. This incorporates data from the literature and the results of a baseline air quality and meteorological monitoring program conducted on the site over a one year period.

The effects on local air quality during construction of the facility are estimated. These mainly result from dust emissions in the various phases of construction, including dust suspended during earth excavation and movement of construction vehicles around the site. Emission estimates are based on a large number of parameters which describe the intensity of the construction activities. Mathematical dispersion modelling is used to translate these emissions into off-site ambient air concentrations, which are then compared to relevant standards and criteria. The potential for off-site nuisance effects due to construction dust emissions is also assessed.

A similar approach is used to assess the effects of air emissions during operation of the proposed facility. Emission estimates are derived for each of the facility components, including the incinerator and organic unloading and storage area, the physical/chemical treatment plant, the landfill and the evaporator. A wide range of potential contaminants are identified, including various acid gases, metals and organic compounds. Again, mathematical dispersion modelling techniques are employed to derive estimates of off-site ambient air concentrations for these contaminants. Concentrations are then compared with relevant air quality standards, guidelines and criteria. As well, the potential for off-site nuisance effects due to dust and emissions of odorous contaminants is assessed.

PREMISES AND POSTULATES

This study was based on two fundamental premises:

- the estimates of emissions and off-site contaminant concentrations are based on the reference design of the facility at the time the analysis was carried out; the facility capacity given is 150 000 tonnes per annum (t/a), including a single rotary kiln incinerator with a capacity of 30 000 t/a, with provision to expand to 300 000 tonnes per annum (t/a) including a second 30 000 t/a incinerator, and

- the study was restricted to the preferred site previously selected by OWMC, and its vicinity.

In addition, the study made use of a large body of information provided by OWMC and its consultants, e.g., construction plans used in the estimates of dust emissions during construction, chemical compounds which may be contained in the wastes treated at the facility and the emission rates of relative compounds due to unloading, transfer and storage of the wastes.

In the course of the study, it was also necessary to adopt numerous assumptions or postulates in order to complete the various analyses. These are identified in the report. A generally conservative approach was followed in this process, such that, where uncertainty existed, the assumptions would tend to overestimate the magnitude of effects on air quality.

STATUS OF DATA

The major sources of data used in this study are listed below:

- regulations and standards (obtained from several jurisdictions in North America and Europe),
- historical climatological data from Mt. Hope and St. Catharines, Ontario and Buffalo, New York (from the Atmospheric Environment Service and the U.S. National Climate Data Center, respectively),
- data on existing air quality in the Niagara peninsula and elsewhere (obtained from the Ontario Ministry of the Environment and the literature),
- data on construction activities, e.g., equipment used, working hours, excavated areas (from other OWMC consultants),
- data on vehicle movements along site access roads (from other OWMC consultants),
- the incinerator supplier's expected and guaranteed values for emissions from the incinerator stack (other OWMC consultants and test data from literature),
- emissions data for the organic unloading and storage area, the physical chemical treatment plant and evaporator (other OWMC consultants), and
- data on the excavation and operation of the landfill, e.g., equipment used, quantities of material removed and replaced (other OWMC consultants).

Information on regulations and standards was used to determine compliance of facility emissions with the legal requirements in the Province of Ontario and to assess the degree to which the facility would also meet the requirements of other jurisdictions. Since regulations in this field are evolving rapidly in both North America and Europe, the assessment with respect to regulatory requirements is subject to change. In particular, fundamental changes are expected soon in regulations governing air emissions in Ontario.

Regional meteorological and air quality data were used in dispersion modelling and in the description of the existing air environment. The most recent and relevant data were obtained for these purposes. Although not collected at the preferred site, it is important to note that such data were used only to supplement measurements made at the OWMC site during the one year baseline monitoring study.

Data on the construction and operation of the facility, including emission data, were based on the reference design at the time this assessment was conducted. Any later refinements in the facility design may change certain results, although they are not expected to alter the fundamental conclusions of the report.

MAIN FINDINGS

The major findings of this study are as follows:

- Air quality data collected at the site during the one-year baseline study show relatively low concentrations of most air pollutants, consistent with the rural nature of the site. Only maximum concentrations of suspended particulate matter and ozone occasionally exceeded the criteria for desirable air quality.

- During construction of the facility, dust emissions are predicted to result in nuisance effects (soiling of surfaces) in areas immediately adjacent to the site (within approximately 100 metres), but only under the most adverse conditions for dust generation and subsequent dispersion.

- Air emissions from facility components are predicted to be well within Ontario air quality standards and guidelines.

- The steam plume from the evaporator will be visible under almost all conditions, when the evaporator is operating. Typically, the plume is predicted to be several hundred metres in length but, under extreme operating and atmospheric conditions, may extend to 2 kilometres or more.

- During operation of the facility, dust emissions, primarily from landfill operations, are predicted to result in nuisance effects (soiling of surfaces) in the immediate vicinity of the OWMC site (within approximately 400 to 500 metres) under the most adverse conditions.

- Exceedances of odour thresholds are predicted for a small number of compounds beyond the site boundary, but only under the most adverse plant operating and weather conditions.

- The overall incremental effect of the facility emissions will not result in exceedances of criteria for desirable air quality.

CONCLUSIONS AND RECOMMENDATIONS

Three major conclusions resulted from this study:

- The facility is expected to operate well within the air quality standards and guidelines established by the Province of Ontario.

- Nuisance impacts due to dust emissions during construction and operation of the facility are expected to be infrequent, of short duration and limited to the site and its immediate vicinity.

- Odours are expected to be limited to the OWMC property. The potential exists for occasional detectable odours beyond the property boundary under the most adverse conditions, but mitigation measures are available to deal with such incidents should they occur during actual operation of the facility.

A number of recommendations are made in the report respecting mitigation of effects, monitoring and further studies. These include recommendations for:

- a reassessment of the facility in light of expected changes to the Ontario regulations governing air emissions, once the proposed changes are published,

- monitoring of construction activities to ensure that off-site impacts due to dust are kept within acceptable levels, with implementation of further mitigation measures as required,

- ongoing monitoring and assessment of fugitive emissions in particular during operation of the OWMC facility, with implementation of further mitigation measures as required; the establishment of a complaint bureau is suggested, and

- an ongoing air quality and meteorological monitoring program, including construction, pre-operational and operational monitoring and, thereafter, monitoring for the life of the facility.

1. INTRODUCTION

1.1 PURPOSE AND SCOPE

The main purpose of this report is to document the potential effects on local air quality of air emissions from the proposed Ontario Waste Management Corporation (OWMC) industrial waste management facility in the Township of West Lincoln, within the Regional Municipality of Niagara.

The primary objective of an impact assessment of this kind can be considered to be the definition of the difference between existing or "background" conditions in the environment, and the anticipated conditions of the same environment during construction and during subsequent operation of the proposed facility. The effects of any differences are then assessed in terms of cause-effect relationships. In the case of air emissions, predicted pollutant concentrations in the ambient air should be assessed in terms of the potential risk to human health and potential impacts on the environment. Where possible, the absence or presence of such effects is determined based on the expected degree of compliance with established air quality standards, guidelines and criteria. This latter aspect is considered in this report. The associated human health and ecological risks are addressed in detail elsewhere (Environ, 1987).

A further objective is to determine the degree to which there is a need to mitigate the effects of air emissions. On this basis, appropriate mitigative measures and monitoring programs are identified and developed to minimize risks and impacts.

1.2 BACKGROUND

An overview of the OWMC facility development process is given in Figure 1.1. This report is part of the Phase 4B site specific studies and designs. Earlier, in Phase 3A, the Ontario Research Foundation (ORF) contributed to the identification of candidate areas by locating areas in the Golden Horseshoe region which, due to their geographical location, would be expected to experience relatively poor conditions of atmospheric dispersion, possibly leading to relatively frequent episodes of poor air quality. These areas were excluded from consideration in the selection of OWMC candidate areas. Because of this early influence in the site selection process, air quality and atmospheric dispersion were not considered in the selection of site areas from within the candidate areas, nor in the subsequent selection of potential sites from within the site areas. This approach is appropriate considering the scale at which air quality phenomena occur, and the limited spatial resolution of relevant parameters which could be developed from data available at the time.

In the next component of the study, Phase 3B, the existing air quality across the candidate areas was defined and evaluated (ORF, 1984a) by consolidating available information on meteorology, climatology, topography, atmospheric emissions and ambient air quality. This study also included a preliminary evaluation of fourteen potential incinerator sites, based on air quality considerations and a general review of local potential receptors. The results of this evaluation were included in the overall site selection process, and were an integral part of the data used to select the original eight candidate sites (Dillon, 1984). The locations of these sites are shown in Figure 1.2.

In the most recent study, in Phase 4A (ORF, 1985), a detailed comparative evaluation of the candidate siting options was carried out, based on considerations of air quality and atmospheric dispersion. The work encompassed the selection of factors and indicators used to

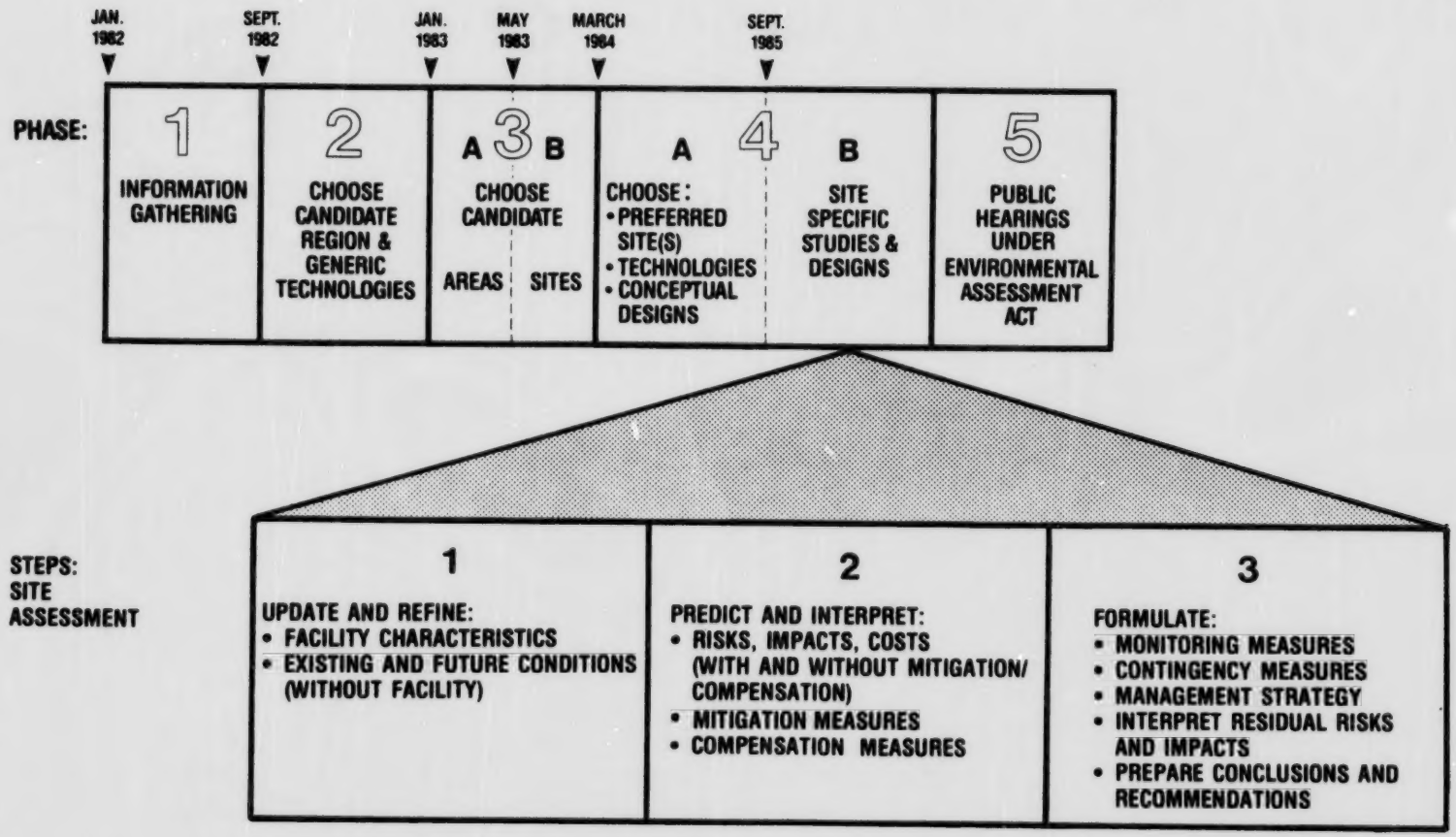
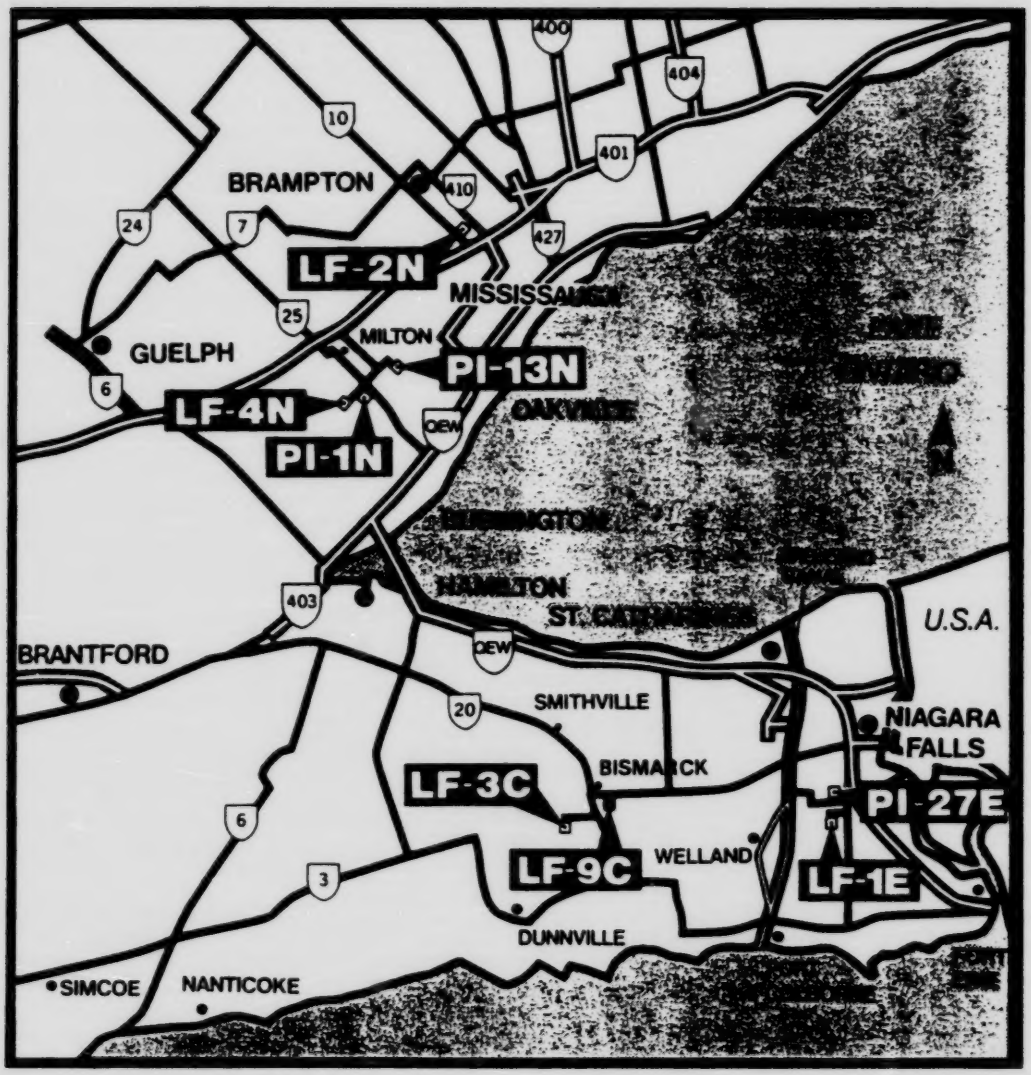


FIGURE 1.1
Facilities Development Process

FIGURE 1.2

Locations of the Candidate Sites



Candidate Sites
Note: Symbols indicate location only, and not size or shape of sites.

LEGEND

- ■ Preferred Site
- ═ 400 Series Highways
- — Other Highways & Roads

Site Name	Landfill	Physical/ Chemical	Incinerator	
LF-2N	•	•		
LF-4N	•	•		
LF-3C	•	•	•	Integrated
LF-9C	•	•	•	Integrated
LF-1E	•	•	•	Integrated
PI-1N		•	•	
PI-13N		•	•	
PI-27E		•	•	

characterize the siting options, the analysis of site-specific data relating to the selected indicators, the ranking of the options under each indicator, the assignment of weights to the indicators and, finally, the aggregation of the results to establish an order of preference of the siting options from an air quality perspective. The report also addressed the selection of the candidate site options from among the seven candidate sites (some options involving two sites) and the sensitivity of the order of preference to certain changes in the analysis. Although data were originally collected and analyzed for eight candidate sites, the comparative evaluation was performed on siting options involving seven sites. The eighth site (LF-2N in Mississauga) was excluded as a candidate site in May 1985 for reasons unrelated to air quality and atmospheric dispersion (Dillon, 1985).

The results of ORF's Phase 4A study were used in the overall evaluation of siting options (Dillon, 1985). Based on this evaluation, OWMC announced in September 1985 the selection of their preferred site (LF-9C) in the Township of West Lincoln for the proposed industrial waste management facility.

1.3 SITE AND FACILITY CHARACTERISTICS

The preferred site is situated in the Township of West Lincoln, approximately six kilometres east of Bismarck on the south side of Highway 20 (see map, Figure 1.3).

The key elements of the facility will be (Monenco, 1987):

- A rotary kiln incineration plant, which burns organic wastes at high temperatures and discharges the resultant gases to the atmosphere after they have been cleaned.

Township of West Lincoln, Regional Municipality of Niagara. Local Detail.

0 1 2 3 4 Miles

0 1 2 3 4 Kilometres

OWMC Ontario Waste Management Corporation

FIGURE 1.3

Location of the OWMC Preferred Site

- A physical/chemical treatment plant, which treats inorganic wastes and removes contaminants using proven physical and chemical processes. The contaminants are solidified in concentrated form (residues) while the treated effluent is evaporated to the atmosphere. Selected aqueous organic wastes are also pre-treated using physical/chemical processes, prior to incineration.

- A solidification plant, which mixes reagents such as cement with the residues of incineration and physical/chemical treatment, to immobilize the contaminants in a solid mass.

- An engineered landfill, into which the solidified residues are placed.

A perspective of the proposed facility is shown in Figure 1.4. The facility is designed to handle a total of 150 000 tonnes of wastes per year. Provision has been made to double the capacity of the facility to 300 000 tonnes per annum (t/a), if required.

The rotary kiln incinerator with a secondary combustion chamber will thermally destroy the organic wastes. Off-gases will be cleaned by a flue gas treatment system. It is expected that acid gases will be controlled by means of a wet scrubbing system and particulate matter by an electrostatic precipitator. Residual contaminants in the flue gas will then be discharged through a 60 m stack. Potential air emissions from the incinerator stack include the following pollutants: acid gases (such as sulphur dioxide, nitrogen oxides and hydrogen chloride), trace metals, various organic compounds, and particulate matter.

Emissions other than those from the incinerator stack, i.e., fugitive emissions released at or near ground level, can be expected from other components of the facility. Fugitive emissions of particulate matter are expected from the following activities: physical/ chemical treatment, incinerator ash handling, landfill soil removal and

replacement, and vehicle traffic. Fugitive emissions of volatile organic compounds can be expected from the following process areas: liquid organic unloading and storage (i.e., from the truck load-out area and the tank farm), liquid organic distribution, and the physical/chemical treatment plant.

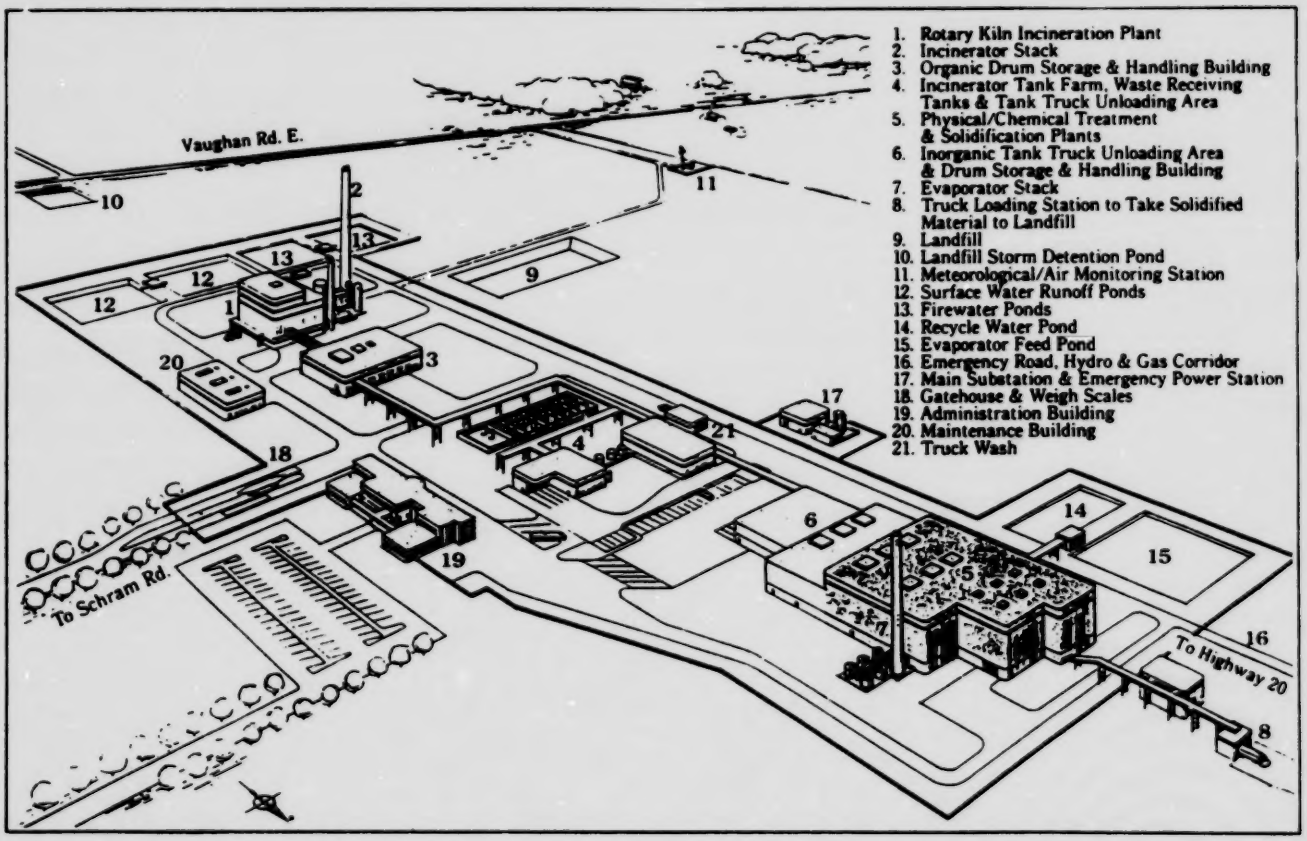
1.4 SCOPE AND GENERAL APPROACH

To establish the basis for the assessment, an important initial step is to review and summarize the regulations governing air emissions in Canada and Ontario, together with relevant regulations from other jurisdictions. A survey of relevant international regulations is included in this part of the assessment. The second major component of the assessment incorporates the data describing the existing air environment of the preferred site. These data are drawn from the literature, including earlier site selection reports, and the results of a baseline air quality and meteorological monitoring program conducted on the site over a one year period. The third major component is the pertinent engineering features of the proposed facility, particularly potential points of emission of contaminants to the atmosphere and estimates of emission rates.

The assessment then proceeds to the quantification of the emissions and the prediction of the consequent concentrations of contaminants in the ambient air around the facility. The principal tools used in these predictions are various mathematical dispersion models. The predicted air quality effects due to the facility, taken together with the existing air quality, then enable the impact assessment to be made (i.e., in terms of the predicted versus existing air quality, and the predicted emissions and resulting ambient air quality as compared to applicable air quality standards, guidelines and criteria).

FIGURE 1.4

Perspective of the Proposed OWMC Industrial Waste Treatment and Disposal Facility



The results of this assessment were provided as input to the overall OWMC Environmental Assessment (OWMC, 1987), under two factors, namely:

- effect of emissions on ambient air quality during construction, and
- effect of emissions on ambient air quality during normal operation.

In the course of this work, a variety of data and other information were obtained from other OWMC consultants for use in the analysis. As well, data were provided to other consultants for use in their analyses. Table 1.1 summarizes the major exchanges.

This assessment addresses in detail the effects on air quality of the normal operation of the proposed 150 000 t/a facility, including a single rotary kiln incinerator of 30 000 t/a capacity. The effects of doubling the facility capacity to 300 000 t/a (including two incinerators) are also addressed, with reference to the effects of the 150 000 t/a design.

The potential for some air emissions during de- commissioning of the facility is recognized. However, details of the site clean-up plan which would allow an assessment of the extent and effect of these emissions are not currently available. Accordingly, the effects of de-commissioning are not addressed in this report. As well, the effects of process upsets and accidental emissions are not included. These are addressed as part of the hazard analysis of the facility (Battelle, 1987).

1.5 SUMMARY OF STUDY LIMITATIONS

Every effort has been made to make the best use of the available data and to ensure the accuracy of the analyses. However, there are a number of

TABLE 1.1

Major Information Exchanges with other OWMC Consultants

Nature of Information	Provided to:	Obtained from:
• Construction Plan, including areas to be excavated, equipment usage, etc.		Monenco
• Incinerator emission estimates for metals and products of incomplete combustion, based on literature	Environ	
• Incinerator emission estimates and other parameters based on facility design		Monenco/Von Roll
• Evaporator emission estimates		Monenco
• Fugitive emission estimates for volatile organic compounds		Environ
• Landfill excavation and operating plan, including excavation quantities, equipment usage, etc.		Monenco/Dillon
• Traffic on access roads during construction and operation		Dillon
• Dispersion factors for incinerator stack, evaporator stack and fugitive emissions	Environ	

limitations inherent in the data and analyses. The more significant limitations are identified below.

The study makes extensive use of mathematical dispersion modelling. The models, although widely accepted and based on theoretical and empirical evidence, give only broad representations of the real physical processes involved. A number of assumptions and approximations are built into the models. Furthermore, these models are limited by the representativeness of the meteorological data, which are necessary inputs to the models. Nevertheless, the results presented are based on the best available meteorological data, including measurements obtained during the on-site baseline monitoring program. Specific details of the data used in this study are discussed later in this report.

A number of conservative assumptions have been made regarding emissions from the proposed OWMC facility. In general, where uncertainty exists in quantifying emissions, conservative assumptions have been made, thus overstating the likely effects on air quality. It should also be noted that the analysis is based on the reference design and operations plan at the time this work was undertaken, and is subject to change should certain aspects of the design or operations of the facility be revised in the future.

Notwithstanding the above limitations, the analysis is considered to provide a conservative estimate of the effects of the facility's air emissions on ambient air quality during the construction and normal operations of the facility, considering currently available information.

2. REGULATORY FRAMEWORK FOR AIR EMISSIONS

2.1 INTRODUCTION

The primary basis for assessing both the existing air quality at the OWMC site and the impact of the proposed industrial waste facility will be the standards, guidelines and criteria established by the Province of Ontario, Canada and other jurisdictions. Certainly, compliance with Ontario's air quality standards must be demonstrated in order to meet the legal limits on air emissions. As well, in general, the standards, guidelines and criteria have been established to protect human beings, vegetation, animals and property against significant adverse effects. Thus, if compliance can be demonstrated, protection against adverse effects can be predicted with a high level of confidence, particularly if the most stringent requirements from the various jurisdictions are considered. Further detailed considerations of risks to human health and ecology are included in a separate study (Environ, 1987).

To establish the basis for the assessment, in this chapter the relevant regulations respecting air emissions in Ontario and Canada are given together with a summary of requirements currently in force or proposed in other jurisdictions in North America and Europe.

2.2 GENERAL APPROACHES TO AIR POLLUTION REGULATION

There are two basic legislative approaches to the regulation of emissions of air pollutants and their resulting impact on air quality; ambient air quality standards and performance or emission standards. Ambient air quality standards define the allowable levels of contaminants in air generally prevailing over the jurisdiction concerned. Emission standards focus on control of emissions at the source, (i.e., in the form of allowable emission concentrations or emission rates at the point of discharge to the air).

There is often considerable ambiguity in the air pollution literature as to the meaning of the term "standard". In a narrow definition, it refers only to allowable levels which are legaliy enforceable. However, the term may also be used to encompass a much broader range of "goals", "objectives", "criteria" and "guidelines" which may not be directly enforceable, but are sometimes used as limits in voluntary control programs or in legally enforceable permits and licenses. Unless otherwise stated, in the following discussion the word "standard" is used in this broader sense.

Air pollution standards are usually quantitative and define the amount of pollutant which should not be exceeded in order to prevent the occurrence of adverse effects. Health effects on humans are the primary concern, but many standards also address effects on plants and animals, materials and the physical state of the atmosphere (i.e., reduced visibility). These standards are referred to as "limiting" regulations, since they establish a numerical limit which may not be exceeded (Henz, 1984). There may also be "administrative" regulations which are more objective in nature. These can have general application or may, on the other hand, be concerned with a specific aspect of a specific source of emissions.

In an ideal process for setting air pollution standards, it is possible to identify the following steps (Franson et al, 1982, Newill, 1977):

- Formulation of the objective, including the definition and selection of the air resources to be protected and the regulatory effort to be applied.

- Preparation of criteria, which express current knowledge of the relationships between numerical pollutant concentrations in air and the resulting adverse effects.

- Development of air quality goals. These are developed from the criteria and define the levels believed to prevent any adverse effects.

- Establishment of ambient air quality standards. These standards are the levels which the jurisdiction will attempt to achieve based on technical considerations of the air quality criteria and non-technical considerations of economics, politics and other factors. The standards may fall short of the goals, since it may not be judged feasible to meet the goals in the foreseeable future.

- Establishment of emission standards for specific source types, which are set with the objective of achieving the ambient standards. Again, both technical and non-technical considerations may apply.

- Establishment of monitoring and enforcement programs. Measurement of both ambient air and emissions may be required to ensure that the emission standards selected are compatible with the ambient air quality standards, and to check that emitters are fulfilling requirements.

This ideal scheme is unlikely to be followed in its entirety in the real world, although some of the elements are included in the standard setting process used in many jurisdictions.

Ambient air quality standards can take a number of forms. In an extensive review of air quality management around the world, Martin and Stern (1974) identified the following eight types:

- Ambient Standards, in which limits are placed on pollutant concentrations in air to which people and things are generally exposed throughout the jurisdiction in question.

- Quasi-emission standards, often referred to as "point-of-impingement" standards", which define allowable levels of contaminants in ambient air downwind of a source which are used in conjunction with dispersion models to determine the corresponding limits on emissions from that source.

- Fluoride standards, expressed as fluoride content in vegetation, especially forage.

- Particulate deposition standards, measured by exposed containers which collect particulate matter deposited by sedimentation, washout and other processes (now generally considered to be an obsolete method).

- Soiling index standard, measured by the light transmitted through or reflected from a spot of particulate matter collected on a filter.

- Sulphation rate standard, which is a cumulative measure of the atmosphere's sulphur content through its ability to convert lead oxide to lead sulphate (now largely replaced by continuous sulphur dioxide monitors).

- Numerical odour and visibility standards.

- Episodic action standards, sometimes referred to as supplementary control standards and represent concentration levels at which emergency air pollution control measures are initiated in the affected area.

Emission standards imply "control-at-source", rather than the use of dilution of emissions to achieve satisfactory ambient air quality. Such standards can apply to an entire site or facility, specific processes, specific pollutants or source categories, (i.e., chimneys, vents or fugitive emissions). Limiting regulations of this type are usually expressed directly in terms of the amount of pollutant that can be emitted from a source, although they may also be expressed indirectly in terms of equipment design standards, fuel composition standards or other subjective criteria. As an example of the latter, it is interesting to note that the first emission standards prohibited the emission of "black", "dense" or "dark" smoke and offensive odours (Stern, 1977).

2.3 ENVIRONMENTAL PROTECTION ACT (ONTARIO)

2.3.1 GENERAL PROVISIONS

The Environmental Protection Act (as revised, 1985) is the primary legislation regulating the emission of contaminants to the environment in Ontario. "Contaminant" as defined in the Act, includes any solid, liquid, gas, odour, heat, sound, vibration, radiation or combination of any of these which may:

- impair the quality of the natural environment for any use that can be made of it,
- cause injury or damage to property or to plant or animal life,
- cause harm or material discomfort to any person,

- adversely affect the health or impair the safety of any person,
- render any property or plant or animal life unfit for use by man,
- cause loss of enjoyment of normal use of property, or
- interfere with normal conduct of business.

Section 5(1) provides that:

"No person shall deposit in, add to, emit or discharge into the natural environment any contaminant, and no person responsible for a source of contaminant shall permit the addition to, emission or discharge into the natural environment of any contaminant from the source of contaminant in any amount, concentration or level in excessive of that prescribed by the regulations."

The regulation under the Environmental Protection Act which defines allowable levels of air emissions is Regulation 308. This is addressed later in Section 2.3.2.

In addition to the limiting regulations contained in Regulation 308, the Act also includes a number of administrative controls. Under Section 8 of the Act, all new or modified sources of air emissions must obtain a certificate of approval (air) prior to construction. There are certain exceptions to this provision (i.e., small residential heating units, motor vehicles, and any equipment used in agriculture). The Act also provides for the issuance of "control orders" (in which specified controls must be placed on the source of contaminant in question), "stop orders" (in which the source of contaminant must stop discharging to the environment) and "program approvals" (a voluntary program for control of an emission submitted by the emitter to the Ministry of the Environment for approval).

2.3.2 REGULATION 308

This regulation is specific to air pollution and includes:

- Provision for the preparation of an "air pollution index" and the control of industrial emissions when the index reaches certain levels (Section 4).

- Provision for the preparation of a visible emission chart and the prohibition of visible emissions which exceed given levels of opacity (Sections 7 and 8).

- Procedures to be followed in notifying the Ministry in the event of abnormal emissions or emissions which exceed the allowable limits (Section 9).

- Controls on the burning of fuels (Section 10) and emissions due to sandblasting, construction, demolition, drilling, etc. (Section 11).

- Allowable emissions of organic matter from incinerators, including incinerators used for burning liquid industrial waste, industrial slurries or sludges. The limit is expressed as a concentration of organic matter in the combustion gases "having a carbon content, expressed as equivalent methane, being an average of ten measurements taken at approximately one minute intervals, (of) 100 parts per million by volume, measured on an undiluted basis" (Section 12).

- Concentration "point of impingement" standards which should not be exceeded and the dispersion calculations which may be used to determine contaminant concentrations (Section 5).

- Prohibition of any air emissions which may "cause discomfort to persons, cause loss of enjoyment of normal use of property, interfere with normal conduct of business, or cause damage to property" (Section 6).

Regulation 308 is reproduced in Appendix A and includes Schedule 1, the list of point-of-impingement standards. The dispersion calculations prescribed in the regulation are reproduced as Appendix B.

It will be noted that the standards imply an indirect limit on emissions, but allow for the effects of dispersion. Thus, factors such as the height of a stack and local land use may play a part. The limits apply to concentrations at the "point-of-impingement", or the point at ground level or an elevated receptor (e.g., an apartment building) where, using the dispersion calculations, concentrations are predicted to be the highest. Points on the emitter's property are not generally considered, unless the public has free access to these locations.

There are currently 100 standards, as shown in Appendix A. These are 1/2-hour average concentrations usually expressed as micrograms per cubic meter of air ($\mu g/m^3$). They have been derived from air quality criteria developed by the Ministry of the Environment (MOE). These criteria incorporate the scientific knowledge of pollutant effects, including those on human health, vegetation, animals and materials. "Nuisance" effects (i.e., odour or soiling) are also considered.

In addition to the standards, the MOE has established "tentative standards", "guidelines" and "provisional guidelines", expressed in similar terms to the standards (i.e., as ambient point-of-impingement concentrations averaged over 1/2-hour). These are not directly enforceable under the Environmental Protection Act. The Ministry has provided the following definitions for the four categories (MOE, 1987):

Category I - Standards (Point-of-Impingement)

These values were established with a high degree of confidence on the basis of data availability covering all aspects of the contaminant effect. They have been approved by the Ministry's Environmental Air Standards Setting Committee and Cabinet, and have been officially published in the Ontario Gazette. Standards are used for both abatement action and new source approval. In any appeal action of an Order or denial of a Certificate of Approval, the applicability of standards is not open to question.

Category II - Tentative Standards

Sufficient data are considered available in this category to produce firm standards. The tentative standards proposed have been approved by the Environmental Air Standards Setting Committee but have not yet received approval nor have they been published in Ontario Regulation 308. Tentative standards can be used for abatement action (e.g., Control Orders) and for the assessment of applications for Certificates of Approval in much the same manner as full fledged standards. However, in any appeal (to the Environmental Appeal Board), these values may be questioned with regard to their appropriateness.

Category III - Guidelines

The lack of data in one or more aspects of the contaminant prevent recommendation of firm standards. However, the available data are considered adequate to justify the setting of limit values with some confidence. Under these circumstances the recommended values are examined and passed by the Environmental Air Standards Setting Committee as guidelines.

Guidelines will be issued by the Chairman of the Standards Setting Committee to the interested branches of the Ministry for use in abatement action or in the granting of conditional Certificates of Approval, subject to reassessment when the standards are produced. Again, in any appeal action the appropriateness of the guideline values may be questioned.

Category IV - Provisional Guidelines

Air contaminants in this category are lacking definitive data in several important aspects, and extensive time will be required to obtain the necessary information. Nevertheless, a working value is urgently needed. The Chairman of the Environmental Air Standards Setting Committee will recommend provisional guidelines based on initial responses from the Environmental Health Studies Section of the Ministry of Labour and any other data which may be obtained on short notice. The values produced can be used in abatement action or in the granting of conditional Certificates of Approval, subject to reassessment when the standards are produced. As in the previous category, in any appeal action, the appropriateness of these guideline values may be questioned.

These last three categories are not part of the general air pollution regulation. However, they are used in the process of evaluating applications for Certificates of Approval, and in assessing the acceptability of existing sources. As of March 9, 1987, there were 242 chemicals listed under the tentative standards, guidelines and provisional guidelines (MOE, 1987).

Appendix A contains a current list of standards, tentative standards, guidelines and provisional guidelines with the corresponding criteria and limiting effects upon which they are based.

2.3.3 REGULATION 296

In addition to the Ontario standards, guidelines and criteria discussed above, a separate regulation under the Environmental Protection Act (Regulation 296) sets out desirable ambient air quality levels or criteria for 23 contaminants. Unlike the point-of-impingement standards, these are not directly enforceable. The criteria are given in Table 2.1. It is interesting to note that the levels for carbon monoxide, nitrogen dioxide, suspended particulate matter, ozone and sulphur dioxide are generally similar to the top of the acceptable range for the corresponding time period in the Canadian Ambient Air Quality Objectives (see Section 2.4). An exception is the 1-hour criterion for sulphur dioxide (690 $\mu g/m^3$), which falls at about the mid-point of the Canadian acceptable range (450-900 $\mu g/m^3$). As well, some time periods included in the Canadian Objectives are not used in the Ontario criteria (i.e., 1 year for nitrogen dioxide, 1 year and 24 hours for ozone).

2.4 CLEAN AIR ACT (CANADA)

2.4.1 GENERAL

Under the Canadian Clean Air Act (1970), federal pollution control activity is mainly limited to a leadership and advisory role in assisting the provinces to develop their own standards, which are then enforceable through provincial legislation (Franson et al, 1982). As part of this role, national ambient air quality "objectives" have been developed in consultation with provincial agencies. There are no offence provisions related to these objectives, so they are not directly enforceable. The Act also authorizes the federal cabinet to publish national emission guidelines (not directly enforceable) and national emission standards for particular classes of stationary sources, where emissions from such sources would constitute a significant health hazard or are likely to result in violation of an international treaty to which Canada is a

TABLE 2.1
Ontario Ambient Air Quality Criteria
(Regulation 296)

Contaminant	Unit of Measurement	Average Amount of Concentration or Total Amount of Contaminant	Period of Time	Approximate Equivalent at 10°C and 760 mm Hg Pressure
Arsenic	Micrograms of arsenic per cubic metre of air	25	24 hours	
Cadmium	Micrograms of cadmium per cubic metre of air	2.0	24 hours	
Carbon Monoxide	Parts of carbon monoxide per one million parts of air by volume	30 13	1 hour 8 hours	36,200 $\mu g/m^3$ 15,700 $\mu g/m^3$
Dustfall	Tons of dustfall per square mile per month	20 total 13	30 days 1 year	
Fluorides (Gaseous) April 15 to October 15	Parts of fluorides per billion parts of air by volume (Expressed as HF)	1.0 0.4	24 hours 30 days	0.86 $\mu g/m^3$ 0.34 $\mu g/m^3$
Total Fluorides (Gaseous and Particulate) April 15 to October 15	Parts of fluorides per one billion parts of air by volume (Expressed as HF)	2.0 0.8	24 hours 30 days	1.72 $\mu g/m^3$ 0.69 $\mu g/m^3$
Total Fluorides (Gaseous and Particulate) October 16 to April 14	Parts of fluorides per one billion parts of air by volume (Expressed as HF)	4.0 1.6	24 hours 30 days	3.44 $\mu g/m^3$ 1.38 $\mu g/m^3$
Fluorides in Forage for Consumption by Livestock	Parts of total fluorides per one million parts forage (dry weight)	35	Individual Sample	

TABLE 2.1 (cont'd)
Ontario Ambient Air Quality Criteria
(Regulation 296)

Contaminant	Unit of Measurement	Average Amount of Concentration or Total Amount of Contaminant	Period of Time	Approximate Equivalent at 10°C and 760 mm Hg Pressure
Fluoridation (total) April 15 to October 15	Micrograms of total fluorides collected by 100 sq. centimetres of limed filter paper	40	30 days	
Fluoridation (total) October 16 to April 14	Micrograms of total fluorides collected by 100 sq. centimetres of limed filter paper	80	30 days	
Hydrogen sulphide	Parts of hydrogen sulphide per one million parts of air by volume	0.02	1 hour	30 $\mu g/m^3$
Lead	Micrograms of lead per cubic metre of air	5.0 2.0 geometric mean	24 hours 30 days	
Mercaptans	Parts of mercaptans per one million parts of air by volume (Expressed as methyl mercaptans)	0.01	1 hour	20 $\mu g/m^3$
Mercury	Micrograms of mercury per cubic metre of air	2.0	24 hours	
Nickel	Micrograms of nickel per cubic metre of air	2.0	24 hours	
Nitrogen Dioxide	Parts of nitrogen dioxide per one million parts of air by volume	0.20 0.10	1 hour 24 hours	400 $\mu g/m^3$ 200 $\mu g/m^3$
Oxidants (total)	Parts of total oxidants per one million parts of air by volume	0.10	1 hour	

TABLE 2.1 (cont'd)
Ontario Ambient Air Quality Criteria
(Regulation 296)

Contaminant	Unit of Measurement	Average Amount of Concentration or Total Amount of Contaminant	Period of Time	Approximate Equivalent at 10°C and 760 mm Hg Pressure
Ozone	Parts of ozone per one million parts of air by volume	0.08	1 hour	165 $\mu g/m^3$
Soiling	Coefficient of Haze per 1,000 feet of air	1.0 0.5	24 hours 1 year	
Sulphation	Milligrams of sulphur trioxide per 100 sq. cm of exposed lead peroxide per day	0.7	30 days	
Sulphur Dioxide	Parts of sulphur dioxide per one million parts of air by volume	0.25 0.10 0.02	1 hour 24 hours 1 year	690 $\mu g/m^3$ 275 $\mu g/m^3$ 55 $\mu g/m^3$
Suspended Particulate Matter	Micrograms of suspended particulate matter per cubic metre of air	120 60 geometric mean	24 hours 1 year	
Vanadium	Micrograms of vanadium per cubic metre of air	2.0	24 hours	

party. There are currently no federal emission standards or guidelines pertaining to air emissions from industrial waste treatment facilities.

2.4.2 AMBIENT AIR QUALITY OBJECTIVES

National ambient air quality objectives have been established for the following: sulphur dioxide, suspended particulate matter, carbon monoxide, ozone and nitrogen oxides. As shown in Table 2.2, three levels are specified for each contaminant, as follows (Environment Canada, 1980).

- Maximum Desirable Objectives are long-term goals for air quality and provide a basis for an anti-degradation policy for the unpolluted parts of the country. Concentrations between zero and the Maximum Desirable Level are said to be in the Desirable range.

- Maximum Acceptable Objectives are intended to provide adequate protection against harmful effects upon soil, water, vegetation, materials, animals, visibility, personal comfort and well being. Concentrations between the Maximum Desirable and the Maximum Acceptable levels are said to be in the Acceptable range.

- Maximum Tolerable Objectives denote concentrations that require abatement without delay to avoid further deterioration of conditions to an air quality that endangers the prevailing Canadian lifestyle or, ultimately, to an air quality that poses a substantial risk to public health.

2.5 POTENTIAL REGULATORY DEVELOPMENTS IN ONTARIO

2.5.1 ONTARIO STANDARDS, GUIDELINES AND CRITERIA

The Ontario standards, guidelines and criteria addressed in Section 2.3.2 are normally kept under constant review by the Ministry of the

TABLE 2.2

Canadian Ambient Air Quality Objectives

Pollutant	Concentration Range ($\mu g/m^3$)			Time Period
	Desirable	Acceptable	Tolerable	
Carbon Monoxide	0-6,000	6,000-15,000	15,000-20,000	8 hrs.
	0-15,000	15,000-35,000	-	1 hr.
Nitrogen Dioxide	0-60	60-100	-	1 yr.
	-	0-200	200-300	24 hrs.
	-	0-400	400-1,000	1 hr.
Particulate Matter (TSP)	0-60	60-70	-	1 yr.
	-	0-120	120-400	24 hrs.
Ozone	-	0-30	-	1 yr.
	0-30	30-50	-	24 hrs.
	0-100	100-160	160-300	1 hr.
Sulphur Dioxide	0-30	30-60	-	1 yr.
	0-150	150-300	300-800	24 hrs.
	0-450	450-900	-	1 hr.

Environment. Consequently, the OWMC facility will have to be assessed with respect to any changes which may occur between the preparation of this report and presentation of the formal OWMC proposal. Furthermore, it can be expected that the ongoing operation of the facility and its resulting effects on air quality will be judged against those standards, guidelines and criteria prevailing at the time. Thus, it may be necessary to periodically reassess the facility's air emissions against any changes in the allowable levels of contaminants.

2.5.2 REVISION OF ONTARIO REGULATION 308

Regulation 308 has evolved from a regulation originally enacted in 1968 under the Air Pollution Control Act of 1967. In recent years, the realization of new concerns in the air pollution field and the development of the science of air pollution have resulted in detailed review of certain sections of Regulation 308. For example, it has been noted that the regulation in its present form does not per se address long-range transport of air pollutants and accumulation of pollutants through deposition. As well, it uses an obsolete procedure for evaluating plume opacity, does not satisfactorily address pollutants with "non-threshold effects levels" and fugitive or low-elevation emissions, and the dispersion calculations prescribed are too limited and, in some instances, no longer "state-of-the-art" (MOE, 1985).

In early 1983, a review of the air management program within the Ministry of the Environment was undertaken, and in November 1983, a plan was submitted for the complete review of Regulation 308. The recommended course of action called for the development of a set of proposals for revising the regulation which would then be submitted to concerned groups for comments before incorporation of any changes into the regulatory framework (MOE, 1985).

Subsequently, the Ministry established internal working groups to examine the various technical areas. These groups brought forth a number of recommendations for changes, summarized below (MOE, 1985):

- preparation of an Air Quality Index (as distinct from the present Air Pollution Index) to be used exclusively as a public information tool and not as a legal instrument,

- the requirement of "best reasonable" technology for the control of emissions. Based on this philosophy, emission standards would be established by source group and all sources covered by these standards would be required to meet them,

- improved "state-of-the-art" dispersion models, including explicit consideration of "background" air quality and the effects of nearby emission sources,

- the existing ambient air quality criteria (see Appendix A) to become Air Quality Objectives, which would be directly enforceable on individual sources,

- establishment of separate guidelines for contaminants in soil, foliage, forage, moss bags and snow, and

- certain changes to the wording in Sections 7 and 8 of Regulation 308 pertaining to the control of plume opacity.

These recommended changes were discussed at a workshop in November 1985, attended by representatives of industry, public interest groups, government and air pollution consultants. In addition, a specialist workshop on the extensive changes proposed in the area of dispersion modelling was held in June 1986.

It is understood that a "green paper" on the proposed changes to Regulation 308 will be issued for public comment in late 1987 or early 1988, followed by publication of a "white paper". It is expected that changes to the regulation will then be enacted in 1988.

If the changes recommended by the internal Ministry working groups are carried forward, substantially unchanged, into law in 1988, it is anticipated that significant new requirements will be placed on the air emissions associated with the OWMC facility. This may entail a re-assessment of the facility's air emissions. The precise scope of this re-assessment cannot be determined before publication of the "green paper", at the earliest. However, present indications are that it would include:

- a rigorous demonstration that "best reasonable" technology will be used to control air emissions and that the emissions are the "lowest achievable",

- use of the new dispersion models required by the regulation in conjunction with the new Air Quality Objectives, in place of the present model and the point-of-impingement standards and guidelines,

- demonstration of compliance with any guidelines respecting contaminant concentrations in soil, foliage, forage, etc., and

- deposition standards.

2.6 REQUIREMENTS FOR RELATED FACILITIES AND OTHER JURISDICTIONS

2.6.1 GENERAL

In the following section, information is provided on regulations currently in force for related facilities in Ontario and elsewhere, as well as general air pollution regulations and standards which are relevant from jurisdictions (other than Ontario) in North America and Europe. This information provides a basis for determining whether or not OWMC's proposed facility would meet the most exacting international requirements for the control of air emissions from industrial waste facilities.

2.6.2 REGULATIONS FOR THE DESTRUCTION OF POLYCHLORINATED BIPHENYLS (PCB'S) IN CANADA

There are many acts and regulations which currently govern not only PCB destruction but also the handling, storage, transportation, clean-up and reporting aspects of PCB waste management. PCB's are toxic contaminants that persist in the environment and, as such, their regulation and control is considerably more detailed and demanding than most other pollutants. It should be noted that current provincial PCB regulations are at various stages of development.

As recommended in a recent Environment Canada report (ORF and Envirochem, 1987), the siting and operation of a PCB destruction facility should involve the submission of various applications to regulatory agencies which will eventually result in approval to operate on a commercial basis at a particular site. The evaluation of a submission is based on determining whether or not the applicant's proposal for the destruction of PCB wastes will present an unreasonable risk of injury to health or the environment. In order to perform this evaluation, a considerable amount of detailed documentation must be submitted as part of the regulatory applications. For thermal PCB destruction technologies, this will involve technical data on the incinerator system design, waste feed characterization, waste feed storage and handling facilities and emission treatment and monitoring provisions.

Specific PCB regulations applicable to mobile facilities have been prepared in Ontario (see Section 2.6.3).

Existing and proposed regulations controlling the incineration of PCB wastes are primarily performance based, with secondary conditions limiting the quantities of contaminants that could result in impact on the environment. The principal method of regulating PCB incineration performance is the stipulation of minimum combustion efficiencies, destruction efficiencies, combustion chamber operating temperatures and gas-phase residence times. On the basis of hazardous waste incineration

data obtained on a commercial-scale, experience has led to the conclusion that available incinerators are capable of achieving the required level of performance specified in U.S. regulations (Hunt and Egan, 1985). As identified in an earlier report (Concord, 1986), specific PCB incineration performance criteria vary according to the provincial regulatory agency, but a minimum combustion efficiency of 99.9 percent and a minimum destruction and removal efficiency for PCB's of 99.9999 percent is standard practice. PCB waste feed to the incinerators must be stopped if these combustion criteria are not met. Relevant Canadian PCB incineration performance and emission criteria (Concord, 1986 and ORF and Envirochem, 1987) are presented in Table 2.3.

Emission standards regulate the disposal of solid and liquid residues, and the discharge of gaseous emissions from a process. Gaseous emissions are the residual trace constituents remaining in the incinerator flue-gases after having been treated in a flue-gas control system. These gaseous emissions may contain trace amounts of unburned organics, hydrogen chloride from the combustion of the chlorinated organic waste, PCB's, multi-component particulate matter if sludges or solids are burned, and other trace constituents. For incinerators, liquid emissions are normally flue-gas scrubber water which would contain contaminants removed from the flue-gases after they leave the combustion chamber. Solid emissions include slag and ash from the kiln and ash from the flue-gas particulate control equipment. Flue-gas ash is dry if removed by a dry device such as an electrostatic precipitator, or in a wet slurry form if removed by a wet device such as a venturi scrubber. These emission streams must not contain contaminants above specified levels or they will require further treatment before disposal. It should also be noted that effluent dilution would not be approved as a means of meeting allowable discharge levels.

In Ontario, assessment of the resulting impact of facility emissions on the environment is required. For air emissions, this

TABLE 2.3

SUMMARY OF RELEVANT PROVINCIAL PCB INCINERATION PERFORMANCE AND EMISSION CRITERIA

Performance Criteria

Ontario	- Destruction/Removal Efficiency - 99.9999%
Quebec	- Combustion Efficiency - 99.9% - Destruction/Removal Efficiency - 99.9999% - Combustion Conditions - minimum temperature of 1250°C for a gas-phase residence time of 2.5 sec. and minimum 3% excess O_2
Alberta (proposed)	- Destruction/Removal Efficiency - 99.9999% - Control System - flue-gas scrubber and electro-static precipitators or equivalent

Emission Criteria

Ontario - Liquids	- Liquid effluents with up to 5 µg/ℓ PCBs may be discharged without treatment
	- Liquid effluents for discharge must not contain greater than 0.25 ng/ℓ of the congener groups tetrachlorinated to octachlorinated dibenzo dioxins or tetrachlorinated to octachlorinated dibenzofurans based on a 1 litre sample size
- Solids	- Solid residues with less than or equal to 50 mg/kg PCBs are to be disposed of in a properly certified waste disposal site
Quebec - Air	- Flue-gas concentrations limited to the following: - 50 mg/Nm^3 particulate matter - 75 mg/Nm^3 hydrogen chloride
- Liquid	- Hazardous PCB liquid wastes requiring treatment are those with concentrations greater than or equal to 300 µg/ℓ (0.3 ppm)

- Solids

PCB Concentration	Disposal Procedure
> 50 ppm	Hazardous waste disposal methods
15-50 ppm	Secure landfill
< 15 ppm	Sanitary landfill

TABLE 2.3 (cont'd)

SUMMARY OF RELEVANT PROVINCIAL PCB INCINERATION PERFORMANCE AND EMISSION CRITERIA

Alberta (draft)	- Air	- Flue-gas concentrations are limited to the following: - 70 mg/m^3 particulate matter - 150 mg/m^3 hydrogen chloride - 140 mg/m^3 carbon monoxide
	- Solids	- Solid residues may be discharged as a non-hazardous waste in an industrial landfill if containing less than: - 5 ppm PCB's - 3 ppb tetra chlorinated dibenzo-p-dioxins (TCDD's)

<u>Environmental Criteria</u>

Ontario	- Air	- Some pertinent maximum 1/2-hour average point-of-impingement standards are as follows (see also Appendix A): - 0.45 $\mu g/m^3$ PCB's - 0.00045 $\mu g/m^3$ polychlorinated dibenzo-p-dioxins (PCDD's) and polychlorinated dibenzo furans (PCDF's) - 100 $\mu g/m^3$ hydrogen chloride - 100 $\mu g/m^3$ particulate matter - 6000 $\mu g/m^3$ carbon monoxide

involves calculating the maximum concentration of contaminants in the receiving environment at a downwind location after discharge and environmental transport. These calculated "point-of-impingement" levels are then compared to ambient air quality standards and guidelines for the contaminants of concern.

As part of a permit to operate a facility, there may be conditions which require monitoring, government inspection and operational data reporting. These conditions are used by the regulatory agency to ensure that the process is operating as proposed.

2.6.3 REGULATION OF MOBILE PCB DESTRUCTION FACILITIES IN ONTARIO

The Province of Ontario has developed regulations to facilitate the use of mobile PCB destruction technologies (Regulation 148/86). These address the use of incineration or other thermo-chemical processes to destroy PCB wastes. Detailed process, emissions and environmental monitoring are required. Emissions must be controlled by continuously monitoring process parameters which are integrated with automatic controls for waste feed and/or process shutdown. Any excursions, indicating exceedances of the air quality standards or guidelines during operation, may result in immediate shutdown of PCB waste feed until the problem has been determined and corrected. The environmental and emissions monitoring requirements of these regulations are designed to ensure that sufficient data are available to identify any significant environmental effects.

In the case of PCB incineration destruction technologies, the stack emissions must be sampled and analyzed for PCB's, dioxins and furans as follows:

- during the first 24-hours of operation at each of the first three sites of operation,

- at least once more for each of the first three sites of operation and, thereafter, at least once in any calendar year in which the unit is in operation in Ontario, and

- after any major maintenance or alteration to the incineration facility which is likely to affect the air emissions of these chemicals.

Pre-operational, operational and post-operational environmental monitoring is also required. To provide confirmation that environmental quality in the vicinity of a site is not impaired, samples of PCB's in ambient air are required. During the first commercial burn of PCB waste, continuous ambient air samples at a minimum of four locations must be collected and analyzed for PCB's. During subsequent commercial runs, sampling must be conducted for dioxins and furans at least one day per week, and for PCB's at two locations a minimum of 2 days per week. In general, pre- and post-operational environmental monitoring is the responsibility of the Ontario Ministry of the Environment.

Under certain circumstances, such as when available data for evaluating the technology is insufficient or when previous tests have only been conducted at the laboratory or at a bench scale, the MOE may require demonstration tests as part of the permitting procedures. During this demonstration test, emissions and environmental monitoring must be conducted. So as to detect any effect of PCB destruction on the local environment, samples of the ambient air must be collected at the demonstration site and evaluated for PCB and chlorobenzene content. These samples must be taken within one week prior to the demonstration test and within 48 hours after the completion of the demonstration test. Emission testing required during the demonstration tests are summarized in Table 2.4.

TABLE 2.4

Stack Emissions Monitoring During PCB Demonstration Tests

Samples Required	Sampling Method	Minimum List of Substances to be Analyzed
Two samples per test, three tests per PCB waste concentration	Method 5 train, modified to include two Florisil traps. Particulate catch and vapour components (impingers and Florisil) to be analyzed separately	PCB, chlorobenzenes, chlorophenols
Same as above	Same as above - separate train required	Polychlorinated dibenzo dioxins, polychlorinated dibenzo furans
One sample per test, three tests per waste PCB concentration	Method 5 train with 5% nitric acid as impinger solution	Particulates, trace metals
One sample per test, three tests per waste PCB concentration	Method 5 train, Texas method	Hydrogen chloride, chlorine
Continuous monitoring	Continuous analyzers	Total hydrocarbons, oxygen, carbon monoxide, carbon dioxide, nitrogen oxides, sulphur dioxide

2.6.4 OTHER NORTH AMERICAN JURISDICTIONS

2.6.4.1 United States Federal Regulations

At the federal level in the U.S., there are four major regulations affecting hazardous waste management facilities. These are the Resource Conservation and Recovery Act (RCRA), the Clean Air Act (CAA), the Toxic Substances Control Act (TSCA) and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The major provisions of each are outlined below:

Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) sets out standards which apply to such facilities as hazardous waste incinerators and boilers and industrial furnaces used to burn hazardous wastes. Hazardous wastes in turn are defined as having a hazardous characteristic (with respect to ignitability, corrositivity, reactivity, or toxicity). Some hazardous wastes are also specifically listed by name. Facilities burning wastes with a hazardous characteristic(s), but no listed components, may be exempted from certain requirements of RCRA.

RCRA includes both interim status standards (which apply to existing facilities operating under interim status until a permit is issued), as well as final technical standards. These technical standards take the form of performance and operating requirements. Performance standards include: 1) a destruction and removal efficiency (DRE) for each principal organic hazardous constituent (POHC) of 99.99 percent; 2) hydrogen chloride (HCl) removal if the HCl emission rate is above 1.8 kg/h. HCl must be controlled such that the HCl emission is below 1.8 kg/h or there is 99 percent removal of HCl; 3) particulate emissions must be below 180 mg/dry standard cubic metre of stack gases. Operating requirements are determined on a case-by-case basis with the view of meeting performance standards. Operating requirements include: 1) control of fugitive emission; 2) automatic

feed shut-off should the incinerator not be operating under permit conditions; 3) operation of hazardous waste feed only when the incinerator is running under steady state conditions.

Although RCRA has been criticized (e.g., the limitations of its definition of hazardous wastes), the purpose of the regulation has been to set minimum requirements. The expection has been that the states would develop their own programs going beyond these minimum requirements.

Federal Clean Air Act

The Federal Clean Air Act (CAA) includes standards for ambient air quality, facility emissions and performance. National ambient air quality standards (NAAQS) have been set primarily to protect public health, and then public welfare. NAAQS have been set for sulfur dioxide (SO_2), carbon monoxide (CO), non-methane hydrocarbons, particulates, ozone (O_3) and lead (Pb). It is the responsibility of the states to set emission limits necessary to achieve these NAAQS.

National Emission Standards for Hazardous Air Pollutants (NESHAPS) have been set for mercury (Hg), beryllium (Be), asbestos, vinyl chloride, benzene and radionuclides for stationary hazardous air pollutant (HAP) sources.

In addition, New Source Performance Standards (NSPS) have been set for major stationary sources in areas not meeting NAAQS and areas subject to non-degradation controls.

Toxic Substances Control Act

The Toxics Substances Control Act (TSCA) includes regulations issued for polychlorinated biphenyls (PCB's) and chlorofluorocarbons (CFC's). In some cases the requirements may be more stringent than those for hazardous wastes regulated under RCRA.

Comprehensive Environmental Response Compensation and Liability Act

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) includes provisions for direct federal government response in case of chemical spills or environmental releases of hazardous substances, as well as remedial work done by the federal government in case of post-closure care and damages from releases. Strict liability is assumed under CERCLA.

2.6.4.2 North American State and Provincial Regulations

In general, the regulation of hazardous waste facilities can be approached by two methods:

- the regulation of facilities through permits; approval usually means meeting operating and performance criteria such as combustion temperature, residence time, turbulence, destruction and removal efficiency, and

- the regulation of toxic air pollutants (TAPS), of which hazardous waste incinerators are just one source. TAPS are controlled either by guidelines or standards, expressed as concentrations in ambient air, emission rates or concentrations at the source, control technology or risk assessment requirements.

In the U.S., TAPS are defined as non-criteria pollutants that may cause adverse human health effects (Cannon, 1986). Criteria pollutants are regulated federally by the U.S. Environmental Protection Agency (EPA). Although TAPS may be controlled indirectly by emission controls of particulates and volatile organics, the effectiveness of this indirect form of control is unknown. Therefore, individual states are developing their own TAPS control programs. In Canada it is within the jurisdiction of the provinces to develop TAPS control programs. Examples of various TAPS control programs that have been set up by individual states and provinces are discussed in Appendix C.

TAPS pose a new and in many ways difficult regulation problem. While there is a great number of potential TAPS, emissions information as well as toxicological data is incomplete. In addition, the use of occupational health data (i.e., Threshold Limit Values or TLV's) in regulating ambient air quality is being questioned. Finally, problems in the legal interpretation of the Clean Air Act have prevented the U.S. EPA from regulating TAPS (Hunt and Egan, 1985). As a result, there are no generally accepted guidelines.

2.6.4.3 Development of TAPS Programs - North America

Alberta and Quebec have TAPS programs (see Table 2.5). In addition, 19 states have TAPS programs in place, while 23 are developing programs, such that there are standards for over 800 chemicals in total (Cannon, 1986). An overview of some of the state TAPS programs is provided in Table 2.6. In developing a TAPS program, the first step is to identify the extent to which TAPS pose a risk to public health. The next step is to develop a program to control this risk.

The identification of the extent of the problem consists of the following steps:

- conducting an inventory of sources and emissions (the State of New York, for example, has a computerized inventory of more than 2000 compounds),

- classifying compounds on the basis of sources and effects; typically, compound classification is simplified to identify only whether or not a compound is a known or suspected carcinogen, and

- estimating both actual exposures (from day-to-day releases) and potential exposures (from accidental releases).

TABLE 2.5

Overview of Toxic Air Pollutants (TAPS) Programs in Canada
(Outside of Ontario)

Area	TAPS in Place	Ambient Air Quality	Emissions	Environmental Control Technology	Impact Review	Operating and Performance Criteria
Alberta	✓	✓	✓(S)	✓(S)	NA	DE (chlorinated organics) = 99.99% (S)
Manitoba	X	(Manitoba Waste Management Corporation being set up)				
Quebec	✓	✓(S)	✓(S)	NA	✓	CE* = 99.9% DE (carcinogenic/ mutagenic/teratogenic wastes) = 99.9999% DE (other wastes) = 99.99% (S)

Notes:

CE = Combustion efficiency
DE = Destruction efficiency
S = Standards
✓ = Yes
X = No
* = Applies to new incinerators
NA = Information not available

TABLE 2.6

Overview of Some U.S. State Toxic Air Programs

Area	TAPS In Place	Program Under Development	Ambient Air Quality	Emissions	Risk Assessment	Control Technology	Environmental Impact Review	Operating and Performance Criteria
California	✓			✓	✓	✓		DRE (POHC's) = 99.99% DRE (PCB's) = 99.9999% CE = 99.9% HCl removal = 99% (G)
Colorado		✓						NA
Illinois	✓		✓		✓	✓(G)		Combustion temperature >1800°F (for halogenated or hazardous wastes) 2200°F (for halogenated aromatics) Residence time = 2 sec Adequate turbulence (G) Chlorinated hydrocarbons 99.9999% removal (PA)
Indiana		✓		✓		✓	✓	NA
Kentucky		✓	✓		✓	✓		NA
Maryland		✓	✓(G)		✓	✓		NA
New York	✓		✓(G)		✓	✓		NA

TABLE 2.6 (cont'd)

Overview of Some of the State Toxic Air Program

Area	TAPS In Place	Program Under Development	Ambient Air Quality	Emissions	Risk Assessment	Control Technology	Environmental Impact Review	Operating and Performance Criteria
New Jersey	✓		✓(G)	✓(S)	✓	✓		DRE (POHC's) = 99.99% HCl removal = 99% Combustion temperature 1800°F 2000°F (for chlorinated wastes) Residence time 2 sec Adequate turbulence (S)
Philadelphia	✓		✓(G)					NA

Notes:

DRE = destruction and removal efficiency
G = guidelines
NA = not available
PA = proposed amendment
POHC = principal organic hazardous constituent
✓ = yes

In developing a TAPS control program, it is important to define the program objectives. These can be protection of public health, safety and well being, protection of the environment, compliance with regulations (federal, state or provincial) or alleviation of public concern. In fact, most of the TAPS programs reviewed are aimed at regulating known or suspected carcinogens.

The type of guideline or standard chosen may be directed at ambient air quality, emissions, risk assessment or control technology. The first three are aimed at controlling the impact of the source, while the last is aimed at controlling the source itself.

Ambient air quality guidelines/standards can apply to the whole country, to a state or province, or even to a city. Most ambient air quality guidelines/standards are presented as Acceptable Ambient Limits (AAL's). Furthermore, AAL's are usually based on occupational data (i.e., Threshold Limit Values (TLV's) that have been adjusted. The City of Philadelphia has taken this approach. However, it is worthwhile noting that adjustment factors are really just a judgement call. Differences between jurisdictions do not only occur in what adjustment factors are used, but also in the averaging times for the AAL's, such as annual, eight hour, one hour or 15 minute averages. Because of these differences in averaging times, it is difficult to compare the stringency of the values. However, since an AAL is a maximum allowable value, the shorter the averaging time associated with a given AAL, the more stringent the AAL (Goldstein, 1986).

Risk assessment/management is another control approach. Risk assessment is the characterization of potential adverse health effects of human exposures to environmental hazards; risk management is the process of evaluating alternative regulatory actions for mitigating those risks (NRC, 1983). Risk assessment, as practiced in California, for example, consists of the following steps: compound selection; health effects evaluation (based on available data); exposure and emissions evaluation

(based on state data); public notification; evaluation of data by a scientific review panel; and a public hearing. Risk management consists of deciding which control measure should be adopted.

Risk assessment/management is often used in the control of carcinogens. Acceptable excess risk (e.g., less than 1 in 1 000 000) and acceptable excess incidents (e.g., less than one per year) are defined and unit risk factors for proven or suspected carcinogens calculated. Kentucky, for example, uses this approach.

In addition to risk assessment (relating to human health), some permit applications for new facilities require an environmental impact assessment (e.g., in Quebec). This involves a qualitative and quantitative assessment of the effects (indirect, cumulative, latent and irreversible) on the environment.

Another control approach that may be taken consists of emissions guidelines or standards. The objective of such a program may be only to comply with federal standards or, in addition, may be to regulate hazardous compounds presently not regulated on a federal level.

The final control approach is in the form of control technology requirements. Regulations may take the form of specifications, as in Alberta, where incinerators must have a tail gas scrubber and electrostatic precipitator (or the equivalent). They may also be of the performance type, for example, in California, where controls resulting in ambient levels that are below the set threshold level are required. Regardless of the type of control approach used, a method of determining compliance is a key component of any successful program. There are basically two approaches for determining compliance, dispersion modelling and actual monitoring (both ambient and source monitoring).

Once a non-compliance situation has been identified, a method of enforcement needs to be in place to deal with it. This can take the form of fines (on an hourly, daily or lump sum basis) and/or imprisonment.

2.6.5 EUROPEAN JURISDICTIONS

2.6.5.1 Denmark

Denmark has a centralized hazardous waste facility, Kommunekemi, which is sponsored by municipal and federal governments and industry. At the national level, with the responsibility of administering environmental protection legislation, is the National Agency of Environmental Protection (part of the Ministry of the Environment). However, it is the local and regional governments which play the major role in environmental protection, as the municipalities must assume responsibility for wastes generated within their boundaries.

The Kommunekemi facility has two rotary kiln incinerators (Geiser, 1985). The National Agency of Environmental Protection sets out emission limits for hydrogen chloride (HCl), hydrogen fluoride (HF), sulphur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), particulates, lead (Pb), asbestos, cadmium (Cd) and mercury (Hg) (Concord, 1986) (see Appendix D). In addition, air quality guidelines for incinerators are to be published shortly (Denmark Chemcontrol, 1986).

2.6.5.2 Sweden

Sweden's national hazardous waste treatment facility, known as SAKAB, is sponsored by municipal and federal governments and industry. According to the Swedish Ordinance on Products Hazardous to Health and to the Environment of 1973, final disposal of hazardous wastes is only to be by SAKAB or those facilities with a special permit.

Traditionally, the control of air pollution in Sweden has been via the licensing procedure of individual stationary sources (Lundquist, 1979). Although the National Environment Protection Board issues recommendations on emissions from incinerators, emission requirements set out in permits are determined on a case-by-case basis. New emission limits are to be implemented in the next few years for hydrogen chloride (HCl), mercury (Hg), particulates (TSP), and dioxins (SAKAB, 1986) (see

Appendix D). In addition, government subsidies act as an incentive to develop pollution control technology.

2.6.5.3 Norway

In Norway, there are a number of decentralized private waste treatment plants run by the cement industry. Norchem is one such cement company that has adapted its kilns to burn hazardous wastes.

The Pollution Control Act of Norway of 1981 includes provisions for permit requirements for waste incinerators. Such permits are granted on a case-by-case basis. Therefore, no general emission standards exist for industrial hazardous waste facilities. However, general emission standards do exist for municipal waste incinerators (which may treat some types of industrial wastes). New emission standards for municipal waste incinerators with a capacity of 20 000 t/a or greater have been proposed for hydrogen chloride (HCl), sulphur dioxide (SO_2), mercury (Hg), cadmium (Cd), carbon monoxide (CO) and particulates (Norges Standardiseringsforbund, 1986) (see Appendix D).

2.6.5.4 West Germany

Hazardous waste incinerators in West Germany are sponsored either publicly (e.g., AGR-KVR), privately (e.g., Bayer) or in a joint public/private venture (e.g., HIM) (Geiser, 1985).

Hazardous waste management facilities are regulated federally under the Federal Waste Disposal Act of 1972 and by the individual states (Concord, 1986). Licensing provisions include the following operating requirements: a minimum combustion temperature of 1200°C and a residence time of 0.3 seconds. In general, licensing provisions are based on TA LUFT (technical instructions for air purification). These provisions pertain to the maintenance of air quality. As a result, two types of standards have been developed. The ambient standards are

concerned with air pollutants affecting humans, animals, plants or other things. These are expressed as ambient air concentrations and as dustfall, and are outlined in Appendix D. Values are given for both long-term and short-term exposures.

The source emission standards are defined in the German regulations as air pollutants originating from a facility. Standards have been set for dusts, inorganic gases and vapours, organics and carcinogens and are also outlined in Appendix D. These standards are relevant to all facilities applying for a licence.

In addition to the general emission standards applicable to all facilities, specific standards exist for certain facilities; for example, facilities involved in the partial or entire elimination of solid or liquid residual materials by combustion, have specific emission standards (given in Appendix D). Where the standards differ, the specific standards take precedence over the general standards.

Finally, state-of-the-art emission controls are required, based on guidelines established by national professional and standards institutes.

2.6.5.5 Great Britain

In Great Britain, emissions from industrial processes, including chemical incineration, are regulated under the Health and Safety at Work etc. Act of 1974, the Health and Safety (Emissions into the Atmosphere) Regulations of 1983, and the Alkali etc. Works Regulations Act of 1906. No general operating and control technology requirements are outlined. However, "best practicable means" of control to prevent emissions are required. Operating requirements for specific facilities granted permits are determined on a case-by-case basis. Emission standards call for no visible smoke and no persistent mist or fume. Specific emission standards are outlined for hydrogen chloride (HCl), hydrogen sulphide

(H_2S) and particulates (see Appendix D). Emission limits for heavy metals, halogens, sulphur oxides and nitrogen oxides are determined on a case-by-case basis.

2.7 CONCLUSION

At the beginning of this Chapter, a background discussion is presented on general approaches to air pollution regulations. This is followed by a summary of the specific regulations currently in force in the Province of Ontario, including specific standards, guidelines and criteria for over 200 contaminants. Compliance with these standards, guidelines and criteria is the primary basis for the assessments, later in this report, of existing air quality (Chapter 3), air emissions during construction of the OWMC facility (Chapter 4), and air emissions during operation of the facility (Chapter 5).

A survey is also provided on regulations for related facilities in Ontario and elsewhere (specifically, PCB destruction facilities) and other general air pollution regulations in North America (outside Ontario) and Europe. This information is used in Chapter 5 of this report, where the proposed OWMC facility is discussed with respect to international requirements on the control of air emissions.

Finally, it should be noted that regulations in this field are evolving rapidly in both North America and Europe. In particular, fundamental changes are expected soon in regulations governing air emissions in Ontario. This may necessitate an update of some information contained in this Chapter, and the assessments based upon it.

3. EXISTING AIR ENVIRONMENT OF SITE

3.1 INTRODUCTION

The purpose of this chapter is to describe the existing meteorology, climatology and air quality of the OWMC preferred site in support of the environmental assessment for OWMC's proposed hazardous waste management facility in the Township of West Lincoln. The description of existing conditions is based on published data from permanent stations measuring air quality and meteorological parameters in the Niagara Peninsula, and other relevant literature, as well as the results of an on-site baseline monitoring program conducted over a one-year period, at the preferred OWMC site (Figure 3.1).

Meteorological and climatic parameters are discussed in Section 3.2; air quality parameters are addressed in Section 3.3.

3.2 METEOROLOGY AND CLIMATOLOGY

3.2.1 SIGNIFICANCE OF SITE METEOROLOGY AND CLIMATOLOGY

The climatology and meteorology of the OWMC preferred site are key factors in determining the ability of the local atmosphere to diffuse or

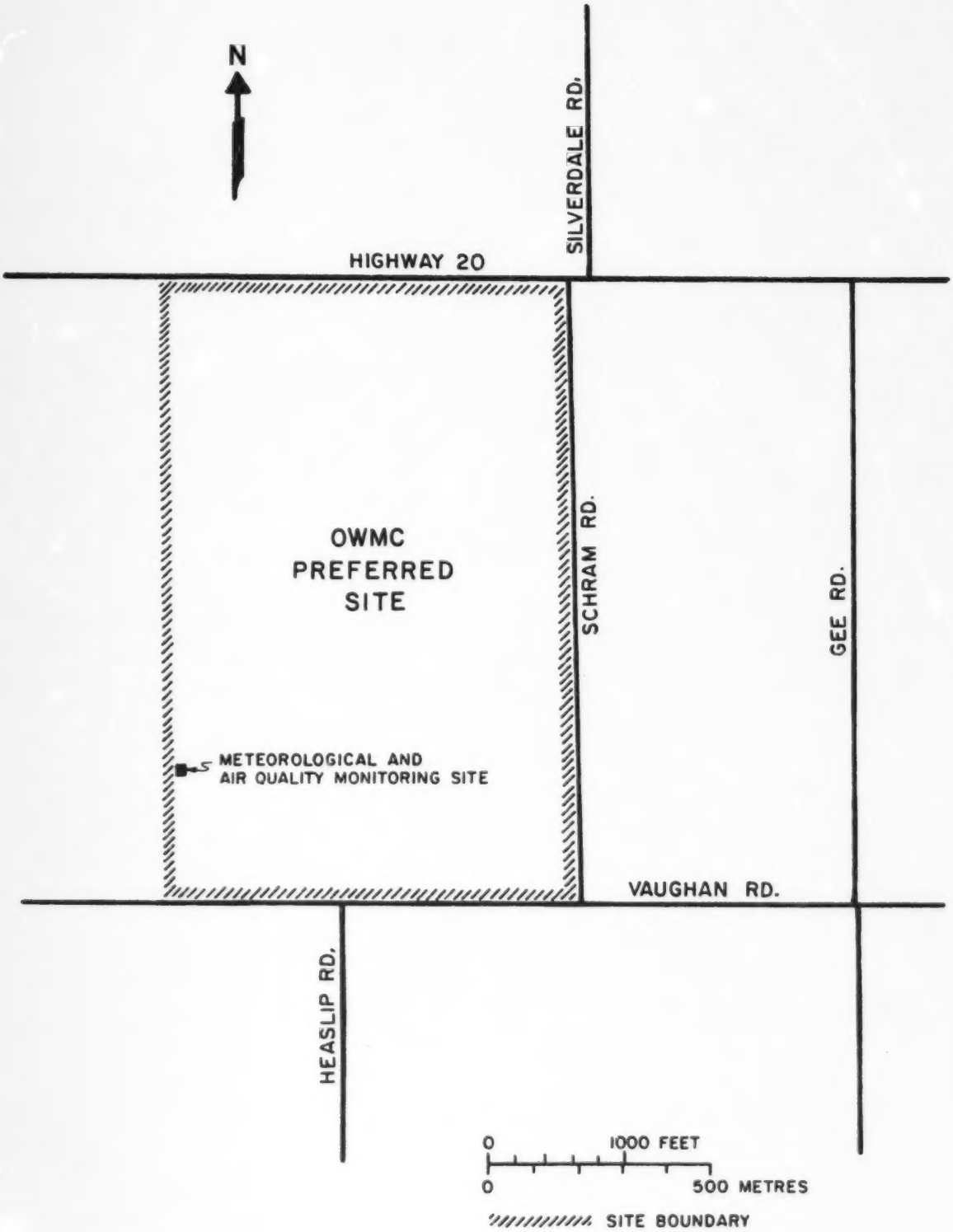


FIG. 3.1
LOCATION OF MONITORING SITE

disperse emissions from the proposed facility. These factors must be described in a quantitative fashion in order to predict the dispersion of emissions and thus determine the impact on ambient air quality. All significant parameters are identified and discussed in the following sections.

3.2.2 CLIMATIC SETTING AND CONTROLS

The proposed OWMC waste management facility would be situated on a parcel of land in the Niagara Peninsula, in the Township of West Lincoln, approximately 6 km east of Bismarck and adjacent Highway 20. The site is located midway between two of the Great Lakes, approximately 28 km south of Lake Ontario and 32 km north of Lake Erie (see map, Figure 1.2).

The region is rural agricultural and is relatively flat. The site is located approximately 20 km from the Niagara Escarpment (on top of the Escarpment). There are no topographic features in the immediate vicinity of the OWMC site which could create meteorological conditions significantly different from the surrounding area.

The major climatic controls which can be expected to influence the dispersion climatology of the OWMC preferred site are prevailing air masses, as modified by the presence of Lakes Ontario and Erie, solar radiation, surface reflectivity, and surface roughness.

According to Hare and Thomas (1974), the Niagara Peninsula is subject to a "continental" climate as modified by the presence of the two Great Lakes (less severe conditions in both summer and winter), although the OWMC site is far enough inland that it is not significantly influenced by the major effects of lake breezes from either lake. The day-to-day weather is variable; precipitation is usually unpredictable but long dry or wet spells are seldom experienced. Precipitation from convective storms in summer is balanced by precipitation from intensive transient low pressure systems in winter. The summers include about

20-25 days of thunderstorms, sometimes with damaging local hail and several periods of uncomfortably hot and humid weather. In late autumn, remnants of tropical hurricanes can create intense storms. In autumn there may also be several periods of hot humid weather (as a result of prevailing high pressure systems) which can create high pollution potential (stagnant conditions). In the winter the region is directly affected by many of the major storms that move across North America, but because of the rapid movement of the low pressure systems, cold spells and snowstorms do not persist. The most severe storms move in from the central U.S. In the spring, intense low pressure systems frequently pass over the region. March and early April bring relatively high winds and thunderstorms, again, become common.

West Lincoln receives approximately 2000 sunshine hours a year, compared to maximum values of 2400 hours and minimum values of 1200 in other parts of Canada. The absorbed solar radiation is the major heat input into the ground influencing the daily cycle of air temperature (which in turn affects atmospheric stability and the dispersion of pollutants). Part of the solar radiation reaching the ground is reflected back, depending on the surface. Over a surface of freshly fallen snow, greater than 80 percent of the solar radiation received is reflected back (not absorbed and therefore not available to heat the lower layers of the atmosphere, thus tending to suppress atmospheric mixing). On the other hand, agricultural areas free of snow can reflect from 20 percent (summer) to 60 percent (winter) of the incoming solar radiation, allowing a more turbulent atmosphere to form in the absence of noticeable winds (Hare and Thomas, 1974).

Surface roughness can be expected to modify surface level winds and turbulence levels, and the variations of wind with height. Generally, the lack of relief at the OWMC monitoring site would indicate minimal variation of these parameters over the surrounding area, although complex flow patterns could develop within, and in the immediate vicinity of, the woodlots.

3.2.3 SIGNIFICANT PARAMETERS

The transport and dispersion of pollutants at a given time and place are determined fundamentally by several parameters (i.e., atmospheric stability, wind speed and direction, mixing height, air temperature and the vertical variation of wind and temperature).

Atmospheric stability can be defined as the tendency of the atmosphere to enhance or resist vertical motion and is inherently related to both vertical wind shear and vertical temperature structure. Stability near the ground is primarily a function of wind speed and net radiation. The Pasquill classification system is one method of describing atmospheric stability. This system designates six stability classes (A to F) which represent a range of conditions from extremely unstable (Class A) (well mixed) to most stable (Class F) (minimal mixing). These categories are determined from the observed wind speed, cloud cover and incoming solar radiation, and provide information on the lateral and vertical spreading of diffusing plumes (Pasquill, 1961).

Mixing heights and wind speed are the parameters commonly used in studying pollution potential, as they help to define the volume of air with which any pollutant will ultimately be diluted. Wind speed also determines the level of atmospheric turbulence present and thus the rate of dispersion of an emission in the atmosphere.

Plume rise is a function of several stack parameters, one of which is stack gas temperature. Hot stack gases released to the atmosphere will rise significantly (in the absence of strong winds) especially when a large temperature differential with the ambient air exists. The greater the plume rise, the better dispersed the plume will be, resulting in lower ground level concentrations. Thus, air temperature is a significant parameter in determining the degree of dispersion.

Vertical wind and temperature profiles are important parameters with respect to plume behaviour. Wind speed, wind direction and temperature above the surface may vary significantly from surface conditions, especially in the presence of certain topographic influences. Such variations within the first few hundred metres are important influences on plume dispersion.

3.2.4 EXISTING DATA

Existing data sources for the significant meteorological parameters in the Niagara Peninsula include several nearby airports, as well as relevant publications. The St. Catharines, Mt. Hope (Hamilton) and, to a limited extent, Niagara Falls airports, as well as several second-order stations recording only temperature, provide historical summaries of wind, stability and air temperature measurements which are helpful in evaluating the climatology of the West Lincoln site. As well, the Buffalo airport has extensive daily radiosonde (upper air) data available. In addition, a climatological study was published by Environment Canada (Portelli, 1977) which provides a useful description of air pollution potential in Canada, on both a seasonal and annual basis, in terms of mixing heights and ventilation coefficients (the product of mixing height and the average wind speed within the mixed layer).

Historical air temperature summaries are presented in Table 3.1 for Canboro, Hamilton, Niagara Falls, St. Catharines, Smithville and Vineland. A range of annual daily means of 7.4 to 8.9^{o}C is shown for these stations. In general, very similar monthly patterns are evident, with January recording the coldest temperatures (daily means ranging from -4.1 to -6.4^{o}C for all six stations) and July recording the highest (daily means ranging from 20.5 to 22.0^{o}C) (Environment Canada, 1982).

Figure 3.2 compares the historical wind roses for the Mt. Hope and St. Catharines airports. The winds at St. Catharines are predominantly from the southwest, with west-southwesterly and westerly

TABLE 3.1: Historical Air Temperature Summaries

	Temperatures (°C)												
	J	F	M	A	M	J	J	A	S	O	N	D	Annual
Daily Mean													
Canboro	-5.9	-4.6	-0.6	6.7	12.0	18.0	20.6	19.8	16.0	9.7	4.0	-2.6	7.8
Hamilton	-6.4	-6.3	-0.8	6.1	12.6	18.0	20.5	20.0	15.7	9.4	3.4	-3.4	7.4
Niag. Falls	-4.6	-4.0	0.6	7.2	13.5	19.3	22.0	21.4	17.3	11.1	4.6	-1.2	8.9
St. Cath.	-4.3	-3.7	0.7	7.2	13.0	19.0	21.7	21.0	17.0	10.9	4.7	-1.0	8.9
Smithville	-5.5	-5.2	-0.3	6.8	12.7	17.8	21.0	20.2	16.3	10.3	4.3	-2.4	8.0
Vineland	-4.1	-3.6	0.7	6.9	12.5	18.4	21.5	20.8	17.0	11.0	5.0	-1.0	8.8
Daily Mean Max													
Canboro	-2.1	-0.4	3.8	12.3	18.3	24.3	27.0	26.1	22.1	15.3	7.9	1.1	13.0
Hamilton	-2.6	-2.1	3.3	11.2	18.2	23.7	26.2	25.7	21.0	14.1	7.1	0.3	12.2
Niag. Falls	-0.9	-0.2	4.8	12.4	19.0	24.6	27.2	26.2	22.0	15.5	8.0	2.1	13.4
St. Cath.	-0.4	0.3	5.0	12.6	18.8	24.6	27.3	26.3	22.2	15.6	8.3	2.3	13.6
Smithville	-1.6	-0.9	4.0	12.1	18.9	23.9	27.0	26.1	22.2	15.7	8.4	1.4	13.1
Vineland	-0.7	0.0	4.3	11.4	17.7	23.5	26.5	25.5	21.6	15.3	8.5	2.2	13.0
Daily Mean Min													
Canboro	-9.7	-8.8	-4.9	1.2	5.7	11.5	14.0	13.5	10.0	4.1	0.1	-6.1	2.6
Hamilton	-10.2	-10.3	-4.8	1.0	7.0	12.2	14.8	14.3	10.5	4.8	-0.2	-7.0	2.7
Niag. Falls	-8.2	-7.7	-3.5	2.1	7.9	13.9	16.8	16.4	12.6	6.8	1.1	-4.5	4.5
St. Cath.	-8.1	-7.5	-3.6	2.0	7.1	13.2	16.1	15.7	11.8	6.2	0.9	-4.4	4.1
Smithville	-9.4	-9.3	-4.6	1.5	6.5	11.6	15.0	14.1	10.4	4.7	0.1	-6.1	2.9
Vineland	-7.5	-7.1	-2.9	2.3	7.2	13.2	16.5	16.0	12.4	6.7	1.7	-4.3	4.5
Extreme Max													
Canboro	16.7	15.0	21.7	27.2	32.8	33.9	36.1	36.1	36.1	29.4	23.3	16.1	36.1
Hamilton	13.3	13.9	23.4	29.4	32.8	33.9	34.4	35.6	34.4	28.9	24.4	16.7	35.6
Niag. Falls	22.2	17.8	26.1	28.9	35.0	34.4	35.6	38.3	35.6	32.8	24.4	18.3	38.3
St. Cath.	14.4	15.6	24.6	28.9	32.1	32.9	35.6	35.6	33.3	28.9	22.2	17.8	35.6
Smithville	14.4	12.8	22.2	29.4	32.8	35.0	35.6	33.9	33.3	27.8	25.6	17.2	35.6
Vineland	20.0	18.3	25.6	29.4	32.8	36.7	39.4	39.4	36.7	31.7	27.2	19.4	39.4
Extreme Min													
Canboro	-30.0	-27.2	-27.2	-13.9	-6.1	-0.6	4.4	-0.6	-3.3	-8.9	-17.8	-25.6	-30.0
Hamilton	-27.8	-26.1	-22.0	-12.8	-3.9	1.7	5.6	1.1	-2.2	-7.8	-12.8	-26.8	-27.8
Niag. Falls	-25.0	-25.0	-20.0	-13.5	-4.4	2.2	5.6	5.0	0.0	-6.7	-12.2	-24.0	-25.0
St. Cath.	-22.2	-25.7	-17.7	-8.3	-1.7	1.7	8.3	6.1	0.6	-5.0	-10.6	-22.5	-25.7
Smithville	-27.8	-25.6	-22.8	-9.4	-4.4	0.6	5.6	1.1	-0.6	-9.4	-11.1	-23.3	-27.8
Vineland	-23.3	-25.6	-18.9	-9.4	-2.2	1.7	6.7	4.4	-0.6	-6.7	-14.4	-26.0	-26.0

FIGURE 3.2
ANNUAL WIND DIRECTIONAL DISTRIBUTIONS AT MT. HOPE AND ST. CATHARINES

MT. HOPE ANNUAL WIND DIRECTION SUMMARY
1970 - 1980

ST. CATHARINES ANNUAL WIND DIRECTION SUMMARY
1971 - 1980

PERCENT FREQUENCY

winds experienced relatively frequently. At Mt. Hope, winds are predominantly from the west with frequent occurrences of west-southwesterly and southwesterly winds. The least frequent wind directions are from the southeast, north (Mt. Hope), northeast (St. Catharines) and east (Mt. Hope). Figure 3.3 shows historical monthly mean wind speeds at these stations. With the exception of slightly higher wind speeds in spring at Mt. Hope, both stations experience very similar wind speeds over the long term. Monthly means are greatest in January and least during the summer months.

Table 3.2 presents the annual joint frequency distribution of atmospheric stability class, wind speed and wind direction, as developed for the Niagara region from previous analyses (ORF, 1984a). This is sometimes referred to as a STAR (STability ARray) analysis. It is evident that stability class D (neutral) can be expected to prevail in this region. This occurs approximately 67 percent of the time, while the unstable and stable classes are expected approximately 19 and 14 percent of the time, respectively.

Joint frequencies of mixing height, wind speed, ventilation coefficient (product of mixing height and wind speed) and wind direction, as measured at Buffalo (the closest upper air station to West Lincoln) are summarized in Tables 3.3 to 3.7 (Environment Canada, 1976). It should be noted that poor dispersion conditions generally correspond to winds less than 4 m/s (1 m/s = 3.6 km/h) and ventilation coefficients less than 6000 m^2/s. From Table 3.3, the potential for these conditions to exist at Buffalo is approximately 17 percent of the time. From Table 3.4, it is evident that the lower ventilation coefficients occur under south-southwest to west and, to a lesser degree, north winds. Table 3.5 indicates that the lower wind speeds tend to occur with south-southwest, southwest, west and north winds. The poorer dispersion conditions would therefore be expected when the winds are from these directions.

FIGURE 3.3

HISTORICAL MONTHLY MEAN WIND SPEEDS AT MT. HOPE AND ST. CATHARINES COMPARED TO OWMC PREFERRED SITE .

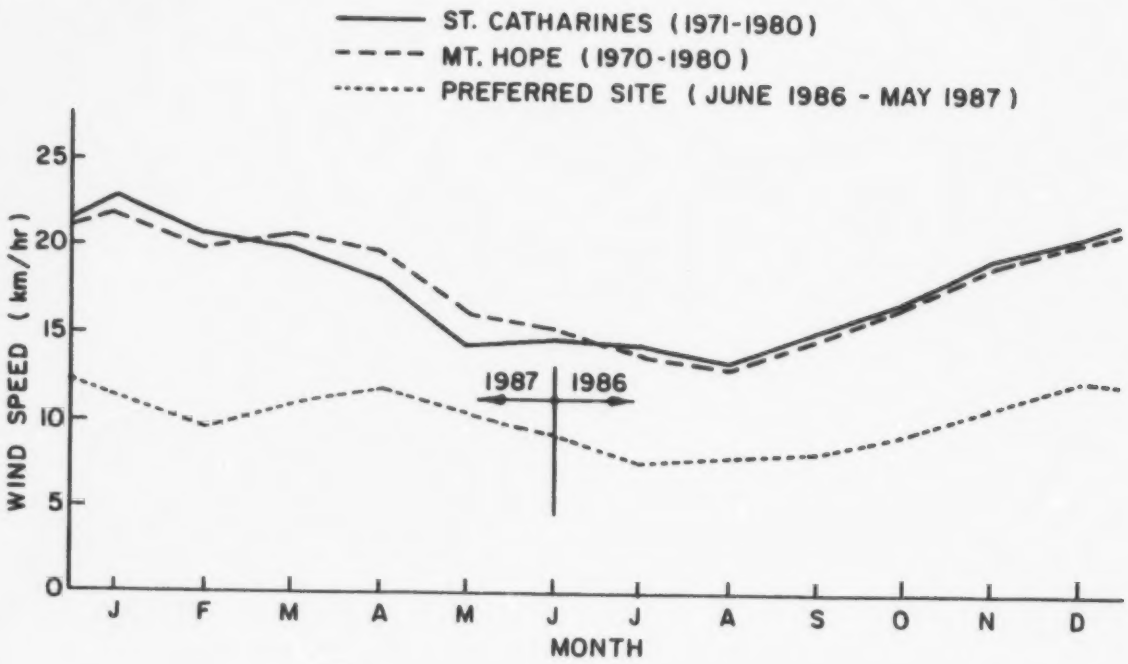


TABLE 3.2

Joint Frequencies of Wind Speed and
Wind Direction by Pasquill Stability Classes
for Niagara region

Direction	Wind Speed (km/h) 0-6	7-13	14-20	21-30	31-40	>40
A STABILITY						
N	.001283	.001372	0.0	0.0	0.0	0.0
NNE	.000382	.000532	0.0	0.0	0.0	0.0
NE	.000093	.000168	0.0	0.0	0.0	0.0
ENE	.000165	.000140	0.0	0.0	0.0	0.0
E	.000190	.000028	0.0	0.0	0.0	0.0
ESE	.000075	.000056	0.0	0.0	0.0	0.0
SE	.000044	.000000	0.0	0.0	0.0	0.0
SSE	.000059	.000028	0.0	0.0	0.0	0.0
S	.000106	.000112	0.0	0.0	0.0	0.0
SSW	.000208	.000140	0.0	0.0	0.0	0.0
SW	.000255	.000224	0.0	0.0	0.0	0.0
WSW	.000177	.000084	0.0	0.0	0.0	0.0
W	.000525	.000476	0.0	0.0	0.0	0.0
WNW	.000528	.000560	0.0	0.0	0.0	0.0
NW	.000556	.000532	0.0	0.0	0.0	0.0
NNW	.000957	.001176	0.0	0.0	0.0	0.0
B STABILITY						
N	.001870	.003557	.002353	0.0	0.0	0.0
NNE	.000947	.001498	.001302	0.0	0.0	0.0
NE	.000669	.001896	.001868	0.0	0.0	0.0
ENE	.000593	.000532	.000238	0.0	0.0	0.0
E	.000879	.000490	.000196	0.0	0.0	0.0
ESE	.000347	.000224	.000210	0.0	0.0	0.0
SE	.000235	.000140	.000028	0.0	0.0	0.0
SSE	.000435	.000070	.000042	0.0	0.0	0.0
S	.001230	.000742	.000504	0.0	0.0	0.0
SSW	.000706	.000728	.000770	0.0	0.0	0.0
SW	.001030	.000714	.000826	0.0	0.0	0.0
WSW	.000911	.000588	.000714	0.0	0.0	0.0
W	.001302	.001582	.001330	0.0	0.0	0.0
WNW	.001073	.002072	.001596	0.0	0.0	0.0
NW	.001075	.002087	.001862	0.0	0.0	0.0
NNW	.001529	.002367	.001470	0.0	0.0	0.0

TABLE 3.2 (cont'd)

Joint Frequencies of Wind Speed and
Wind Direction by Pasquill Stability Classes
for Niagara region

Direction	Wind Speed (km/h) 0-6	7-13	14-20	21-30	31-40	>40
C STABILITY						
N	.001205	.002822	.006210	.000706	.000020	0.0
NNE	.000973	.001794	.004718	.001149	.000000	0.0
NE	.000635	.001391	.004234	.001371	.000020	0.0
ENE	.000533	.001048	.002157	.000343	.000040	0.0
E	.000729	.001149	.002560	.000121	.000000	0.0
ESE	.000657	.000726	.000968	.000081	.000000	0.0
SE	.000413	.000625	.000706	.000000	.000000	0.0
SSE	.000477	.000585	.000786	.000121	.000000	0.0
S	.001475	.002157	.004436	.000786	.000121	0.0
SSW	.001287	.001875	.005766	.002318	.000302	0.0
SW	.001243	.001895	.007077	.004113	.000948	.000262
WSW	.000835	.001734	.005424	.001331	.000161	.000040
W	.001500	.002601	.007944	.001593	.000202	0.0
WNW	.000943	.001774	.006996	.002460	.000101	0.0
NW	.000943	.001794	.005766	.001129	.000020	0.0
NNW	.000909	.001734	.003811	.000665	.000040	0.0
D STABILITY						
N	.001990	.004901	.008065	.008401	.001120	.000084
NNE	.001264	.004060	.007085	.006581	.000364	.000224
NE	.001109	.003808	.009017	.009717	.000924	.000252
ENE	.001309	.004173	.009101	.011005	.003416	.001120
E	.001914	.007169	.016802	.014590	.002856	.000308
ESE	.001082	.003052	.004425	.002716	.000196	.000000
SE	.000702	.001960	.002268	.000840	.000112	.000000
SSE	.000921	.001960	.003024	.002996	.000476	.000252
S	.001620	.005741	.014450	.015878	.004257	.001848
SSW	.001316	.004761	.013946	.031812	.008933	.003248
SW	.001476	.005853	.019630	.050546	.020442	.010781
WSW	.001328	.005125	.016886	.041445	.016102	.006413
W	.001839	.005741	.016886	.041221	.013442	.003976
WNW	.001339	.004425	.011705	.024111	.006609	.002576
NW	.001165	.004285	.009185	.016214	.004957	.001232
NNW	.001244	.003892	.007785	.011761	.002268	.000224

TABLE 3.2 (cont'd)

Joint Frequencies of Wind Speed and
Wind Direction by Pasquill Stability Classes
for Niagara region

Direction	Wind Speed (km/h) 0-6	7-13	14-20	21-30	31-40	>40
E STABILITY						
N	0.0	.001274	.000588	0.0	0.0	0.0
NNE	0.0	.000980	.000490	0.0	0.0	0.0
NE	0.0	.001176	.000392	0.0	0.0	0.0
ENE	0.0	.002254	.000980	0.0	0.0	0.0
E	0.0	.004802	.001274	0.0	0.0	0.0
ESE	0.0	.002646	.000294	0.0	0.0	0.0
SE	0.0	.002156	.000196	0.0	0.0	0.0
SSE	0.0	.003136	.000588	0.0	0.0	0.0
S	0.0	.005488	.003332	0.0	0.0	0.0
SSW	0.0	.004802	.003234	0.0	0.0	0.0
SW	0.0	.004606	.007448	0.0	0.0	0.0
WSW	0.0	.003822	.006762	0.0	0.0	0.0
W	0.0	.002156	.002156	0.0	0.0	0.0
WNW	0.0	.001078	.001666	0.0	0.0	0.0
NW	0.0	.000980	.001470	0.0	0.0	0.0
NNW	0.0	.001078	.001666	0.0	0.0	0.0
F STABILITY						
N	.001170	.000588	.00	0.0	0.0	0.0
NNE	.001287	.000588	.00	0.0	0.0	0.0
NE	.001203	.000672	.00	0.0	0.0	0.0
ENE	.001203	.000672	.00	0.0	0.0	0.0
E	.002994	.001344	.00	0.0	0.0	0.0
ESE	.002256	.001260	.00	0.0	0.0	0.0
SE	.002124	.000924	.00	0.0	0.0	0.0
SSE	.001320	.000672	.00	0.0	0.0	0.0
S	.006153	.003696	.00	0.0	0.0	0.0
SSW	.004530	.002856	.00	0.0	0.0	0.0
SW	.004860	.004284	.00	0.0	0.0	0.0
WSW	.002757	.002520	.00	0.0	0.0	0.0
W	.001821	.001344	.00	0.0	0.0	0.0
WNW	.000954	.000336	.00	0.0	0.0	0.0
NW	.000819	.000588	.00	0.0	0.0	0.0
NNW	.000837	.000336	.00	0.0	0.0	0.0

TABLE 3.3

Upper Air Statistics at Buffalo, New York (July 1965 to June 1969)
Ventilation Coefficient vs Wind Speed

Percent Frequency of Occurrence
Ventilation Coefficient (m^2/s)

Wind Speed (m/s)	0 to 1000	1100 to 2000	2100 to 3000	3100 to 4000	4100 to 5000	5100 to 6000	6100 to 7000	7100 to 8000	8100 to 9000	9100 to 10000	10100 to 11000	11000 +
0-2	1.5	1.0	0.2	0.1	0	0	0	0	0	0	0	0
2.1-4	3.6	2.4	2.6	2.6	1.7	1.5	1.4	0.6	0.1	0	0	0.1
4.1-6	1.6	2.3	1.8	3.0	2.7	2.1	1.8	1.8	1.3	1.1	1.0	1.1
6.1-8	0.6	1.5	1.1	1.6	1.7	1.6	1.7	1.3	0.8	1.0	0.9	4.1
8.1-10	0.5	0.2	0.5	1.4	0.7	1.2	0.8	0.7	0.8	1.2	0.5	5.5
10.1-12	0.1	0.3	0.1	0.2	0.5	0.7	0.3	0.5	0.8	0.3	0.8	5.3
12.1-14	0	0.1	0	0.2	0.3	0.2	0.2	0.1	0.1	0.5	0.5	3.1
14.1-16	0.1	0	0	0.1	0	0.1	0.1	0	0	0.3	0.1	2.4
16.1-18	0.1	0	0	0	0	0	0.1	0	0	0	0.1	1.1
18.1-20	0	0	0	0	0	0	0	0	0	0	0	0.7
20.1-30	0	0	0	0	0	0	0	0	0	0	0	0.5
30.1 +	0	0	0	0	0	0	0	0	0	0	0	0

Missing, Unlimited Mixing and Cold Air Advection Data = 6.1%

TABLE 3.4

Upper Air Statistics at Buffalo, New York (July 1965 to June 1969)
Ventilation Coefficients vs Wind Direction

Percent Frequency of Occurrence
Ventilation Coefficient (m^2/s)

Wind Direction (Degrees)	0 to 1000	1100 to 2000	2100 to 3000	3100 to 4000	4100 to 5000	5100 to 6000	6100 to 7000	7100 to 8000	8100 to 9000	9100 to 10000	10100 to 11000	11000 +
calm	0.1	0	0.1	0	0	0.1	0	0	0	0.1	0	0.1
10-40	0.9	0.5	0.8	0.8	0.3	0.2	0.3	0.1	0.2	0	0.1	0.3
50-80	0.8	0.5	0.7	0.6	0.6	0.7	0.4	0	0	0.1	0.1	0.2
90-120	0.4	0.3	0.4	0.6	0.3	0.6	0.3	0.1	0.1	0.3	0	0.3
130-160	0	0.2	0.3	0.5	0.4	0.3	0.5	0.3	0.2	0.2	0.1	0.8
170-200	0.8	0.6	0.4	1.0	0.7	0.7	0.5	0.3	0.1	0.5	0.5	1.2
210-240	1.1	2.3	1.4	1.2	1.4	1.4	1.2	1.2	0.8	1.1	0.7	7.8
250-280	1.5	1.7	1.2	1.8	1.8	2.1	1.8	1.8	1.2	1.2	1.4	8.5
290-320	1.0	0.8	0.6	1.4	0.8	0.6	0.8	1.0	0.9	0.4	0.5	3.6
330-360	1.4	0.5	0.3	0.6	0.9	0.5	0.3	0.2	0.2	0.1	0.2	0.8

Missing, Unlimited Mixing and Cold Advection Data = 9.0%

TABLE 3.5

Upper Air Statistics at Buffalo, New York (July 1965 to June 1969)
Wind Speed vs Wind Direction

Percent Frequency of Occurrence
Wind Speed (m/s)

Wind Direction (Degrees)	0 to 2	2.1 to 4	4.1 to 6	6.1 to 8	8.1 to 10	10.1 to 12	12.1 to 14	14.1 to 16	16.1 to 18	18.1 to 20	20.1 to 30	30.1 +
calm	0.1	0.1	0	0.1	0.1	0	0.1	0	0	0	0	0
10-40	0.3	2.1	1.4	0.5	0.1	0.1	0	0	0	0	0	0
50-80	0.4	1.4	1.6	0.8	0.5	0.1	0.1	0	0	0	0	0
90-120	0.3	1.0	1.3	0.7	0.3	0.1	0.1	0.1	0	0	0	0
130-160	0	0.6	1.2	1.2	0.6	0.3	0	0.1	0	0	0	0
170-200	0.1	1.6	2.4	1.4	0.8	0.6	0.3	0.1	0.1	0.1	0	0
210-240	0.4	1.8	4.2	3.7	3.9	3.1	2.0	1.3	0.7	0.3	0.1	0
250-280	0.3	2.2	4.3	5.6	4.4	4.5	2.1	1.4	0.5	0.3	0.3	0
290-320	0.2	2.5	2.4	2.8	2.7	1.0	0.5	0.1	0.1	0	0	0
330-360	0.3	2.1	2.1	0.8	0.5	0.2	0.1	0	0	0	0	0
TOTAL	2.5	15.6	20.9	17.5	13.8	10.0	5.3	3.1	1.3	0.7	0.5	0

Missing, Unlimited Mixing and Cold Air Advection Data = 8.8%

From Tables 3.6 and 3.7, it can be seen that all classes of maximum afternoon mixing height are experienced some of the time, and the height classes experienced more than 10 percent of the time include 400 to 599, 600 to 799 and 800 to 999 m.

3.2.5 BASELINE MONITORING PROGRAM

To supplement the abovementioned data, the following meteorological parameters were monitored at the preferred site over a period of one year (June 1986 to May 1987):

- wind speed and direction (at 30 m and 10 m heights - continuously),
- air temperature (at 30 m and 10 m heights - continuously),
- solar radiation (at 10 m - continuously), and
- rainfall and snowfall (rainfall - continuously and events)
  (snowfall - events composited monthly).

In addition, upper air measurements of mixing height, temperature and wind speed and direction were conducted using a minisonde during a two week period each season (with releases every 3 hours).

The monitoring station is situated along the western boundary of the site, and approximately 300 m north of the southern boundary (Vaughan Road) (see Figure 3.1). Wind, temperature and solar radiation were measured on a 30 m meteorological tower.

The continuous sensors were connected to a remote data collection unit which, in turn, transmitted the data once every 24-hours via modems and communication lines to a computer at the Ontario Research Foundation (ORF) for processing. The minisonde system was manually operated, and the data processed at ORF after completion of each seasonal study.

TABLE 3.6

Upper Air Statistics at Buffalo, New York (July 1965 to June 1969)
Maximum Mixing Heights vs Wind Speed

Percent Frequency of Occurrence
Maximum Afternoon Mixing Height (m)

Wind Speed (m/s)	0	1 to 199	200 to 399	400 to 599	600 to 799	800 to 999	1000 to 1199	1200 to 1399	1400 to 1599	1600 to 1799	1800 to 1999	2000 +
0-2	0.1	0.2	0.7	0.7	0.2	0.3	0.1	0.1	0.1	0.1	0.1	0
2.1-4	0.8	1.3	2.2	1.6	1.7	1.7	1.1	1.5	1.4	1.5	0.9	0.8
4.1-6	0.2	1.5	2.3	2.1	2.6	3.2	1.5	2.0	1.6	1.6	1.2	1.7
6.1-8	0.3	0.6	2.1	2.2	2.4	2.3	1.5	1.4	1.8	0.8	1.0	1.5
8.1-10	0.3	0.4	1.2	2.0	1.8	1.4	1.1	1.6	1.4	0.8	1.0	1.0
10.1-12	0.1	0.3	0.5	1.2	1.2	1.2	1.6	1.2	0.8	0.7	0.5	0.8
12.1-14	0	0.1	0.5	0.5	0.7	0.8	0.8	0.5	0.5	0.1	0.3	0.3
14.1-16	0.1	0	0.1	0.1	0.4	0.4	0.3	0.3	0.2	0.5	0.1	0.5
16.1-18	0.1	0	0.1	0	0.1	0.3	0.2	0.2	0.2	0.1	0.1	0
18.1-20	0	0	0	0	0.1	0.1	0.1	0.1	0.1	0.1	0	0.1
20.1-30	0	0	0	0	0	0.1	0	0.1	0	0	0.1	0.1
30.1 +	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	2.1	4.4	9.8	10.3	11.2	11.7	8.4	9.1	8.1	6.4	5.2	6.7

Missing, Unlimited Mixing and Cold Air Advection Data = 6.6%

TABLE 3.7

Upper Air Statistics at Buffalo, New York (July 1965 to June 1969)
Maximum Mixing Heights vs Wind Direction

Percent Frequency of Occurrence
Maximum Afternoon Mixing Height (m)

Wind Direction (Degrees)	0	1 to 199	200 to 399	400 to 599	600 to 799	800 to 999	1000 to 1199	1200 to 1399	1400 to 1599	1600 to 1799	1800 to 1999	2000 +
calm	0	0	0.1	0.1	0.1	0	0	0	0.1	0	0.1	0
10-40	0.3	0.2	0.6	0.5	0.6	0.4	0.3	0.1	0.3	0.5	0.4	0.1
50-80	0	0.5	0.6	0.8	0.6	0.9	0.5	0.2	0.1	0.2	0.1	0.2
90-120	0	0.2	0.2	0.5	0.7	0.5	0.5	0.3	0.4	0.3	0.1	0.1
130-160	0	0	0.3	0.4	0.4	0.7	0.5	0.3	0.4	0.3	0.1	0.4
170-200	0.1	0.5	1.2	1.1	0.5	0.8	0.4	0.7	0.7	0.7	0.4	0.6
210-240	0.4	1.3	2.3	2.0	2.5	2.7	1.9	2.3	1.6	1.4	1.5	1.6
250-280	0.5	0.8	2.6	2.7	3.8	3.6	2.5	2.5	2.5	1.4	1.0	1.8
290-320	0.3	0.5	0.9	1.6	1.0	1.2	0.9	1.7	1.4	1.3	0.9	0.8
330-360	0.4	0.4	1.0	0.4	0.8	0.6	0.3	0.6	0.3	0.1	0.5	0.6
TOTAL	2.1	4.4	9.7	10.1	11.1	11.5	7.8	8.8	7.9	6.2	5.1	6.4

Missing, Unlimited Mixing and Cold Air Advection Data = 8.9%

Appendix E includes the monitoring protocol for meteorological parameters. Information provided in this appendix includes a list of all parameters monitored, specific instruments used and their method of operation, equipment performance characteristics, and calibration and analytical methods.

3.2.6 RESULTS OF BASELINE MONITORING

Table 3.8 summarizes the results of the baseline study for the major meteorological parameters. Hourly results are presented in Appendix F.

Figures 3.4 to 3.7 give the seasonal wind directional distributions compiled from measurements taken at the 10 and 30 m heights above ground level. Figure 3.8 provides the annual wind directional distribution at 10 m at the OWMC preferred site. The overall predominant wind directions were southwesterly to westerly at both 10 and 30 m levels (southwest, west-southwest and west winds occurred 35 percent of the time at 10 m and 35 percent of the time at 30 m). Seasonally, wind directions were predominantly within the southwesterly to westerly sector in the summer, fall and winter, with northeasterly winds also being significant in the spring. The prevailing winds at 10 m were southwest in summer and fall (19 and 14 percent, respectively), west-southwest in winter (20 percent) and southwest and northeast in spring (15 percent each).

Wind speeds were highest during the months of winter and lowest during the months of summer, as indicated in Figure 3.3. The noticeably lower wind speeds recorded at West Lincoln, when compared to the St. Catharines and Mt. Hope airports, may reflect the more exposed locations of the two airports. Nevertheless, the seasonal trends are very similar (calm conditions were defined as wind speeds less than 2 km/h).

Hourly air temperatures at 10 m ranged from 4° to $28^{o}C$ in the summer, -10° to $27^{o}C$ in autumn, -18° to $7^{o}C$ in the winter and -21° to $31^{o}C$ in the spring. The annual mean was $7.4^{o}C$. Generally

TABLE 3.8

Summary of On-Site Baseline Meteorological Conditions

Wind Conditions

	Summer	Fall	Winter	Spring	Annual
Pred. Wind Dir.*	SW	SW	WSW	NE/SW	SW
% Frequency	19	14	20	15/15	15
Mean Wind Speed (km/h)	8.0	9.1	11.1	11.1	9.9
Wind Speed Ranges (km/h)	0-44	0-36	0-37	0-39	0-44

Air Temperatures

	Summer	Fall	Winter	Spring	Annual
Mean (^{o}C) 10 m	NA	10.1	-2.2	8.0	7.4
Range (^{o}C)	NA	-10 to 27	-18 to 7	-13 to 31	-21 to 31
Mean (^{o}C) 30 m	19.8	9.8	-2.3	8.7	9.2
Range (^{o}C)	5 to 30	-11 to 28	-18 to 7	-13 to 31	-21 to 31**

Mean Maximum Afternoon Mixing Heights***

	Spring	Summer	Fall	Winter	Annual
Mean Height (m)	1392	1745	1511	692	1335
Range (m)	162 to > 2790	324 to > 5784	284 to > 3964	162 to > 1539	162 to > 5184

Notes:

NA not available due to insufficient data
* prevailing wind direction, based on 16 compass points (direction that wind is blowing from)
** includes data from March 1986 during start-up of monitoring program
*** data from flights where ground-based inversions were measured was not taken into account when calculating the mean heights

FIG. 3.4 OWMC PREFERRED SITE - DIRECTIONAL DISTRIBUTION OF WIND.
SUMMER 1986

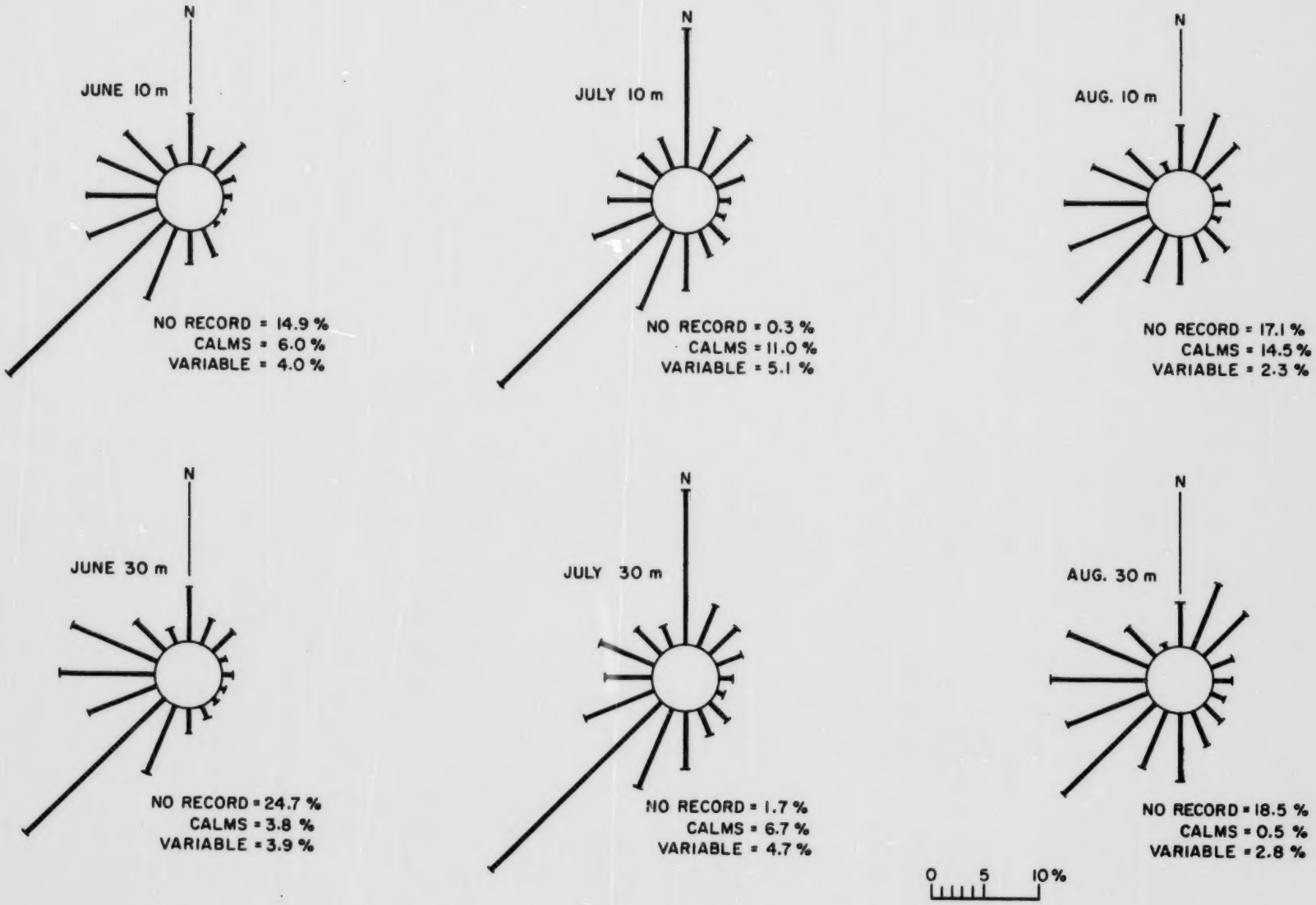


FIG. 3.5 OWMC PREFERRED SITE - DIRECTIONAL DISTRIBUTION OF WIND.
FALL 1986

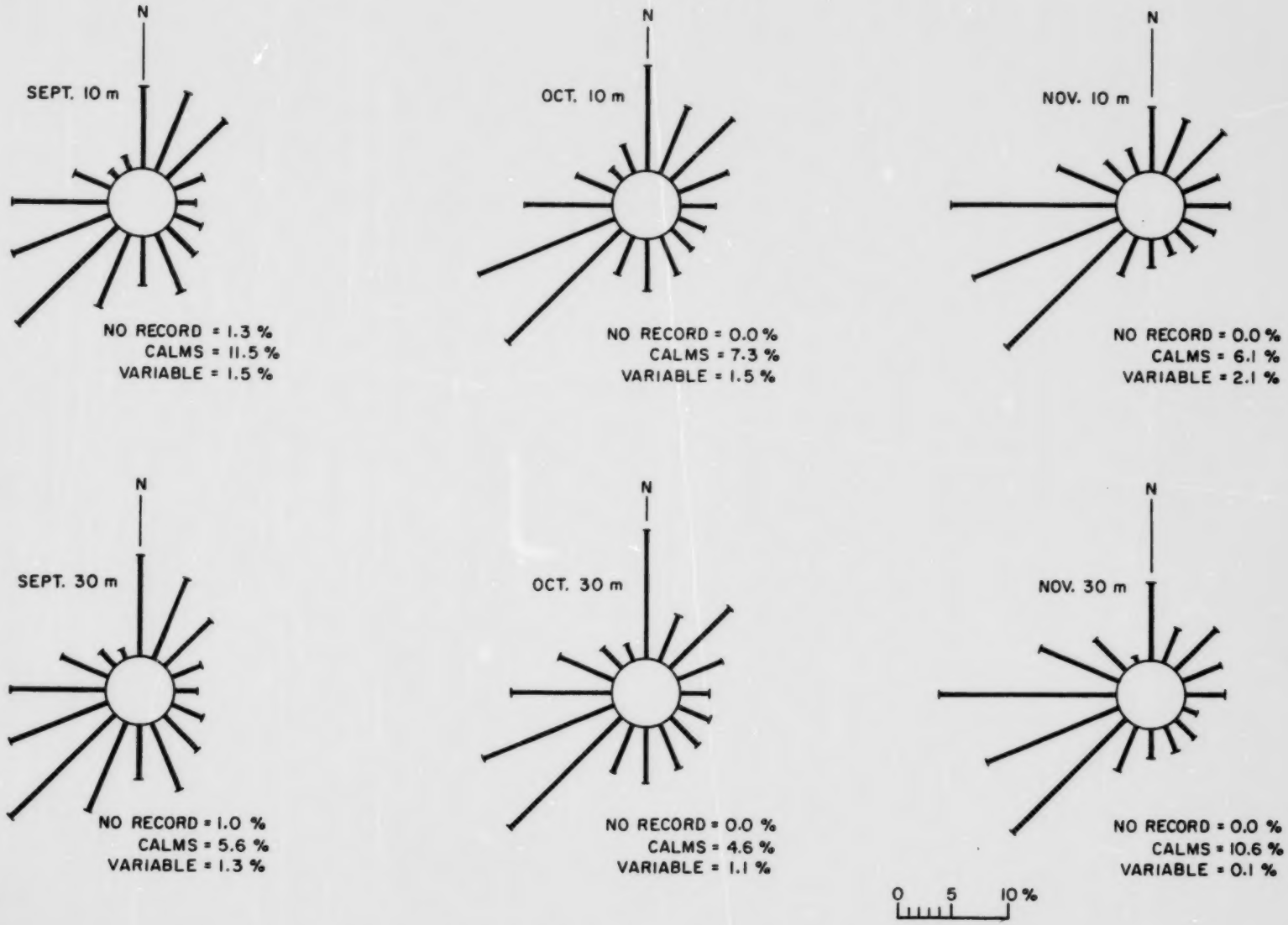


FIG. 3.6 OWMC PREFERRED SITE-DIRECTIONAL DISTRIBUTION OF WIND.
WINTER 1986-7

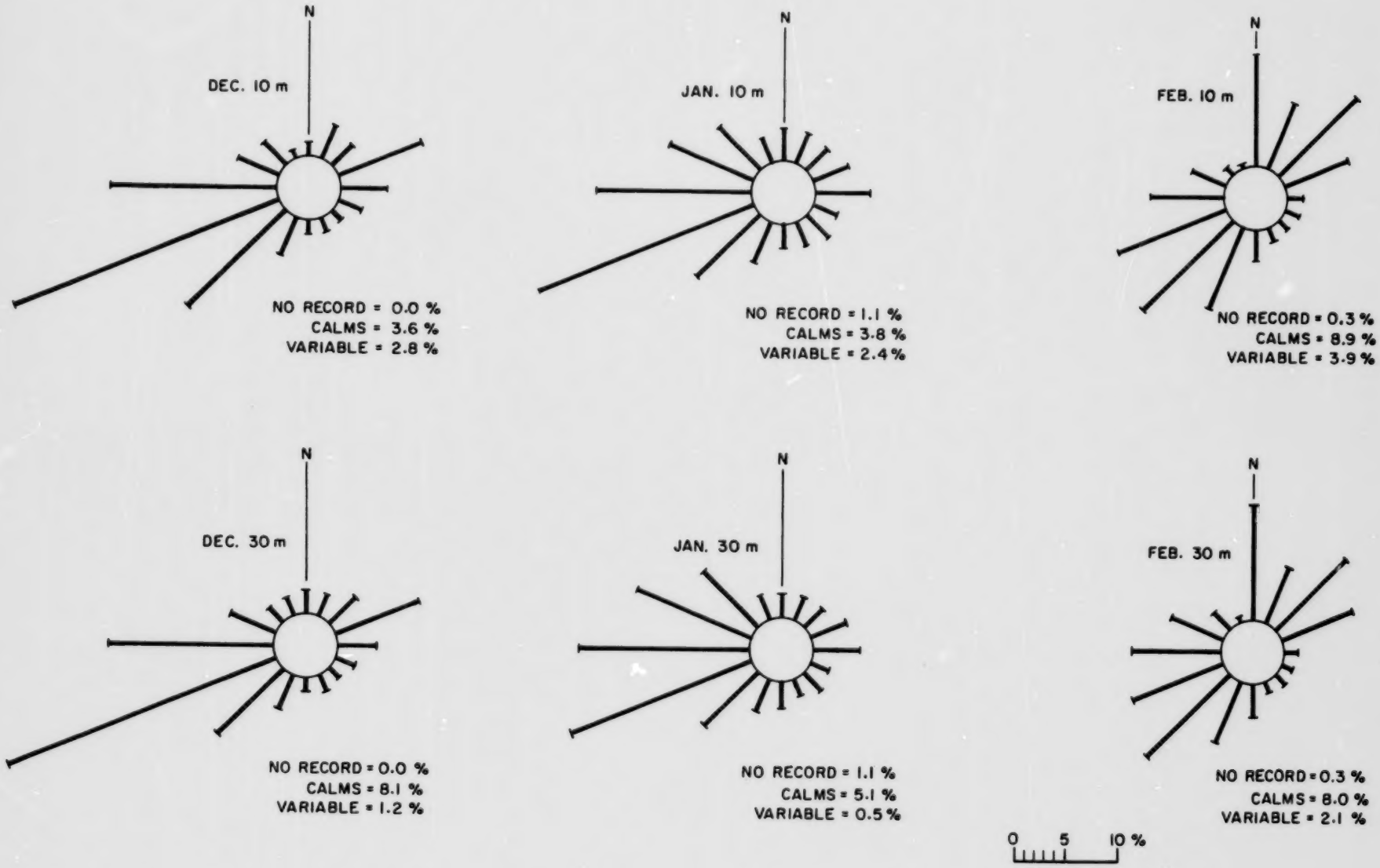


FIG. 3.7 OWMC PREFERRED SITE-DIRECTIONAL DISTRIBUTION OF WIND.
SPRING 1987

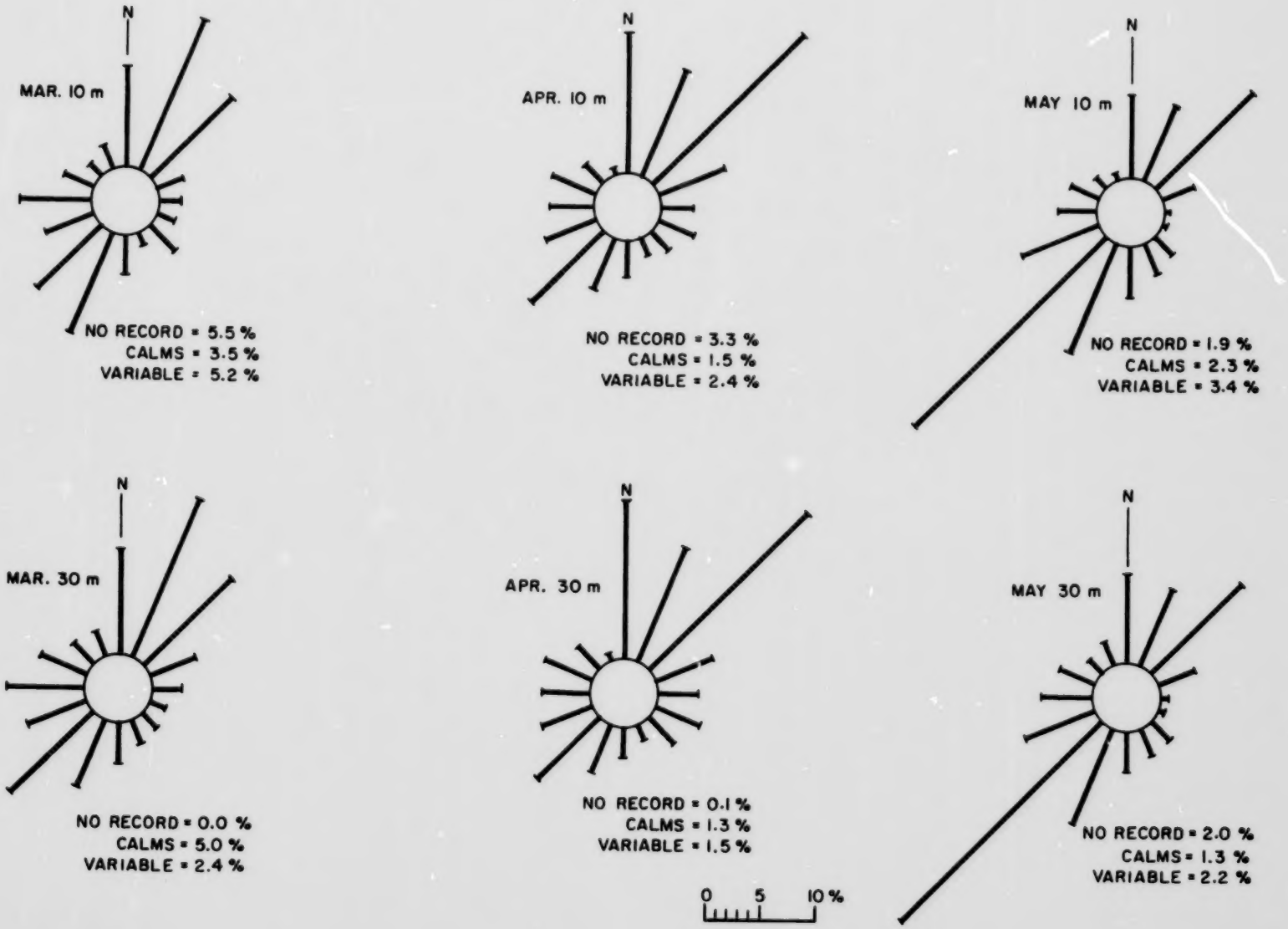
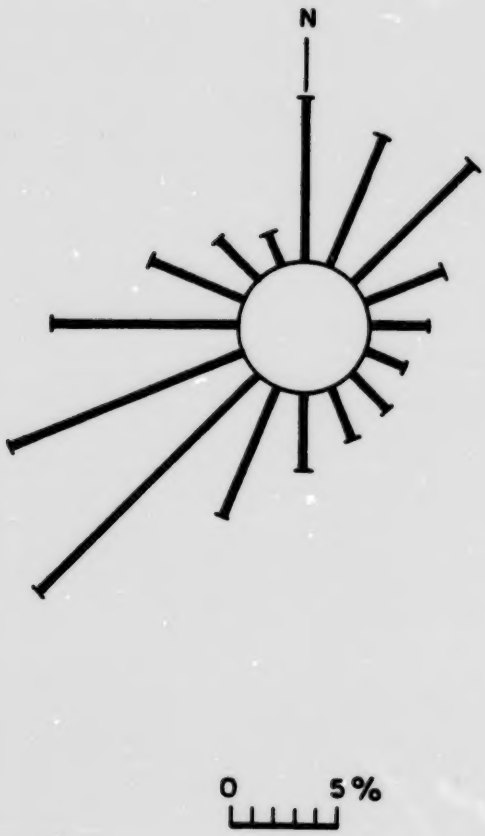


FIGURE 3.8

OWMC PREFERRED SITE
DIRECTIONAL DISTRIBUTION OF WIND
(JUNE 1986 - MAY 1987)

NO RECORD = 3.5 %
CALMS = 3.6 %
VARIABLE = 3.0 %



the temperature difference between the 30 m and 10 m heights was not significant.

Mixing heights were measured intensively during 2-week periods each season. These varied from 0 to greater than 5184 m, with the summer months generally experiencing the greatest mixing heights, and winter experiencing the lowest (see Appendix F).

3.2.7 SYNTHESIS OF SITE DISPERSION CLIMATOLOGY

A site-specific dispersion climatology has been formulated for the OWMC preferred site, based on a synthesis of the one year of "baseline" measurements made on-site with the long-term meteorological data from other stations in the region. One year of wind speed and direction measurements, atmospheric stabilities (derived from solar radiation and wind speed measurements), and mixing heights recorded at the site were compared with the measurements recorded at the same time at the Mt. Hope, St. Catharines and Buffalo airport stations (AES, 1987a, and USNCC, 1987).

Based on a comparison of wind data from Mt. Hope and St. Catharines, with measurements at the site over the one-year baseline period, St. Catharines was chosen as the meteorological station best representing the wind conditions at the OWMC preferred site. However, it was necessary to determine the differences between the two locations brought about by the local features, including the proximity of St. Catharines to Lake Ontario and its associated lake breezes. This was done by tabulating the hourly wind speeds and directions at both locations during the baseline study period. Joint frequencies of wind speed and direction classes were then calculated, as detailed in Appendix G. This analysis resulted in the identification of some significant variations between the St. Catharines site and the OWMC site, namely:

- a greater frequency of calm to light winds, at the OWMC preferred site, and

- more frequent occurrences of west-southwest and north winds at the site and less frequent occurrences of east and south winds.

The joint occurrence matrix for the one year baseline period was used with the annual joint frequency distribution of wind speeds and directions at St. Catharines for the 1977 to 1986 period (AES, 1987b) to provide an estimate of the corresponding long-term distribution at the OWMC preferred site (see Appendix G). The resulting synthesized long-term surface wind rose for the site is shown in Figure 3.9.

Hourly surface stability conditions were calculated for the site during the one-year baseline study, based on a combination of measurements of solar radiation and wind speed (Turner, 1970). This information was compared to the Pasquill stability class data recorded at the St. Catharines and Mt. Hope airports over the same period (but based on cloud and wind speed data). It was found that the Mt. Hope stability data correlated more closely with the stability indicators at the OWMC preferred site. However, due to the uncertainty in the interpretation of the solar radiation data, it was decided to use the stability class data from Mt. Hope. The annual frequencies of occurrence of stability classes A to F for the period 1977-1986 at Mt. Hope are provided in Table 3.9. (AES, 1987b.)

In order to compute the equivalent of a STAR analysis (joint wind speed/direction/Pasquill stability class frequencies) for the OWMC site, the synthesized long-term frequencies of surface wind speeds and directions were combined with the Mt. Hope stability frequencies. Table 3.10 presents the derived joint frequency distributions of wind direction and speed by Pasquill stability class.

It is anticipated that certain activities during both construction and operation of the OWMC facility will be more intense in the summer months, when the weather is more accommodating for earth moving activities. Therefore, for the purposes of modelling the

FIGURE 3.9

SYNTHESIZED WIND DIRECTIONAL DISTRIBUTION AT THE OWMC PREFERRED SITE

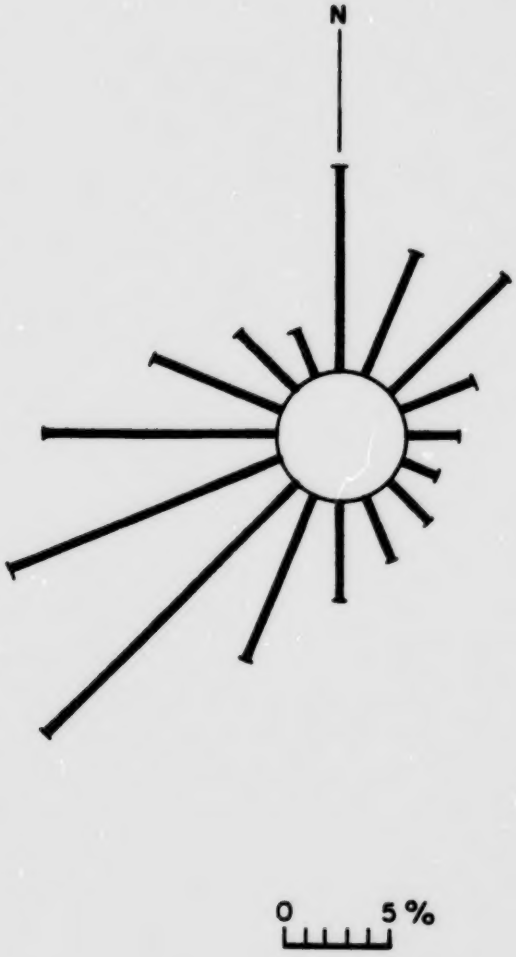


TABLE 3.9

Annual Frequency of Occurrence
of Pasquill Stability Classes
at Mt. Hope (1977-1986)

Stability Class	Relative Frequency of Occurrence (%)
A	0.9
B	5.7
C	13.3
D	66.5
E	7.3
F	6.3

TABLE 3.10

Derived Annual Joint Frequency Distribution
of Wind Direction and Wind Speed
by Pasquill Stability Class at the OWMC Site

Direction	Wind Speed (km/h) 0-6	7-13	14-20	21-30	31-40	>40
A STABILITY						
N	.001709	.001342	0.0	0.0	0.0	0.0
NNE	.000428	.000399	0.0	0.0	0.0	0.0
NE	.000151	.000132	0.0	0.0	0.0	0.0
ENE	.000043	.000016	0.0	0.0	0.0	0.0
E	.000108	.000024	0.0	0.0	0.0	0.0
ESE	0	0	0.0	0.0	0.0	0.0
SE	.000097	0	0.0	0.0	0.0	0.0
SSE	.000044	.000067	0.0	0.0	0.0	0.0
S	.000082	.000050	0.0	0.0	0.0	0.0
SSW	.000109	.000111	0.0	0.0	0.0	0.0
SW	.000250	.000180	0.0	0.0	0.0	0.0
WSW	.000341	.000131	0.0	0.0	0.0	0.0
W	.000508	.000349	0.0	0.0	0.0	0.0
WNW	.000414	.000397	0.0	0.0	0.0	0.0
NW	.000295	.000313	0.0	0.0	0.0	0.0
NNW	.000409	.000458	0.0	0.0	0.0	0.0
B STABILITY						
N	.005034	.007552	.002156	0.0	0.0	0.0
NNE	.002374	.002820	.000961	0.0	0.0	0.0
NE	.001415	.001809	.000632	0.0	0.0	0.0
ENE	.000766	.000628	.000110	0.0	0.0	0.0
E	.000551	.000206	.000044	0.0	0.0	0.0
ESE	.000668	.000355	.000080	0.0	0.0	0.0
SE	.001007	.000456	.000059	0.0	0.0	0.0
SSE	.001120	.000474	.000105	0.0	0.0	0.0
S	.001200	.000709	.000170	0.0	0.0	0.0
SSW	.001078	.000715	.000382	0.0	0.0	0.0
SW	.001516	.001042	.000475	0.0	0.0	0.0
WSW	.001395	.001167	.000375	0.0	0.0	0.0
W	.001973	.001792	.000701	0.0	0.0	0.0
WNW	.001652	.002263	.000743	0.0	0.0	0.0
NW	.001122	.001586	.000686	0.0	0.0	0.0
NNW	.001062	.001555	.000398	0.0	0.0	0.0

TABLE 3.10 (Contd.)

Derived Annual Joint Frequency Distribution
of Wind Direction and Wind Speed
by Pasquill Stability Class at the OWMC Site

Direction	Wind Speed (km/h) 0-6	7-13	14-20	21-30	31-40	>40
C STABILITY						
N	.003654	.006885	.007764	.000317	0	0.0
NNE	.002258	.004842	.005560	.000783	0	0.0
NE	.002409	.003536	.004921	.000767	.000010	0.0
ENE	.000800	.001459	.001214	.000111	.000009	0.0
E	.000542	.000784	.000661	.000007	0	0.0
ESE	.001000	.001090	.000736	.000016	0	0.0
SE	.001509	.002215	.001410	0	0	0.0
SSE	.001647	.001486	.001527	.000092	0	0.0
S	.002153	.002533	.002287	.000171	.000014	0.0
SSW	.001646	.002460	.003681	.001004	.000110	0.0
SW	.002617	.003699	.005745	.001729	.000210	0.0
WSW	.002562	.004379	.004010	.000545	.000051	0.0
W	.002535	.004350	.005258	.000934	.000064	0.0
WNW	.001133	.002354	.003666	.000741	.000027	0.0
NW	.000863	.001863	.002230	.000254	.000004	0.0
NNW	.000846	.001388	.001238	.000112	.000005	0.0
D STABILITY						
N	.009150	.020015	.013888	.007012	.000531	0.0
NNE	.006248	.014134	.010853	.006269	.000284	0.0
NE	.006383	.018031	.015891	.012680	.000826	0.0
ENE	.003937	.008352	.008976	.005652	.001123	0.0
E	.002643	.007065	.006634	.003840	.000473	0.0
ESE	.004471	.007872	.004339	.001554	.000087	0.0
SE	.004556	.012937	.006757	.001432	.000185	0.0
SSE	.005082	.011288	.007144	.003896	.000443	0.0
S	.003849	.010589	.010749	.006660	.001122	0.0
SSW	.003721	.012143	.014557	.019192	.003198	0.0
SW	.004827	.017267	.024837	.037970	.010087	0.0
WSW	.005214	.016056	.023295	.032456	.007892	0.0
W	.005473	.014246	.017379	.024041	.004685	0.0
WNW	.003751	.008576	.010079	.011538	.002248	0.0
NW	.002295	.005989	.005613	.006052	.000915	0.0
NNW	.001715	.004548	.003446	.002972	.000314	0.0

TABLE 3.10 (Contd.)

Derived Annual Joint Frequency Distribution
of Wind Direction and Wind Speed
by Pasquill Stability Class at the OWMC Site

Direction	Wind Speed (km/h) 0-6	7-13	14-20	21-30	31-40	>40
E STABILITY						
N	0.0	.003251	.000545	0.0	0.0	0.0
NNE	0.0	.002498	.000591	0.0	0.0	0.0
NE	0.0	.002907	.000489	0.0	0.0	0.0
ENE	0.0	.001934	.000433	0.0	0.0	0.0
E	0.0	.002285	.000351	0.0	0.0	0.0
ESE	0.0	.003403	.000121	0.0	0.0	0.0
SE	0.0	.005877	.000583	0.0	0.0	0.0
SSE	0.0	.006639	.000489	0.0	0.0	0.0
S	0.0	.005446	.001380	0.0	0.0	0.0
SSW	0.0	.003708	.001370	0.0	0.0	0.0
SW	0.0	.007769	.005279	0.0	0.0	0.0
WSW	0.0	.005417	.003885	0.0	0.0	0.0
W	0.0	.001929	.000608	0.0	0.0	0.0
WNW	0.0	.001191	.000704	0.0	0.0	0.0
NW	0.0	.000726	.000516	0.0	0.0	0.0
NNW	0.0	.000293	.000249	0.0	0.0	0.0
F STABILITY						
N	.001892	.001094	.00	0.0	0.0	0.0
NNE	.001900	.000923	.00	0.0	0.0	0.0
NE	.003557	.001076	.00	0.0	0.0	0.0
ENE	.000900	.000584	.00	0.0	0.0	0.0
E	.001612	.000541	.00	0.0	0.0	0.0
ESE	.002470	.000938	.00	0.0	0.0	0.0
SE	.005410	.001771	.00	0.0	0.0	0.0
SSE	.002445	.000714	.00	0.0	0.0	0.0
S	.004361	.002441	.00	0.0	0.0	0.0
SSW	.004196	.001989	.00	0.0	0.0	0.0
SW	.005418	.004207	.00	0.0	0.0	0.0
WSW	.004481	.002444	.00	0.0	0.0	0.0
W	.001689	.000736	.00	0.0	0.0	0.0
WNW	.001310	.000398	.00	0.0	0.0	0.0
NW	.000377	.000499	.00	0.0	0.0	0.0
NNW	.000481	.000168	.00	0.0	0.0	0.0

dispersion of dust emissions, a site-specific STAR analysis was developed for the summer in the same manner as described above for the entire year. Appendix G contains the details and results of this analysis.

During the baseline studies, mixing heights were measured on-site using minisondes released at three-hour intervals over a two-week period each season. The results were compared to the results of radiosonde releases made at Buffalo, New York (the closest regularly reporting upper air station) over the same time period. The mean afternoon mixing height measured at the site over all four seasons was 820 m, while the mean value recorded at Buffalo was 994 m.

3.3 AIR QUALITY

3.3.1 SIGNIFICANCE OF EXISTING AIR QUALITY

The following Section deals with an assessment of existing air quality at the preferred site. This is needed to determine the cumulative impact of existing levels plus the contribution due to emissions from the OWMC facility, and to identify any existing exceedances of air quality standards and criteria. The assessment is based on data from existing monitoring networks in the area and other studies of regional air quality, together with the results of the one-year baseline monitoring program at the OWMC preferred site.

3.3.2 SIGNIFICANT PARAMETERS

As previously noted, the proposed OWMC facility will treat both organic and inorganic industrial wastes. Organic wastes will be thermally destroyed in a rotary kiln incinerator, and the inorganic wastes rendered stable and non-toxic by physical/chemical treatment processes. Slag from the incinerator, solidified ash from the incinerator flue gas treatment system and solidified residues from the physical/chemical treatment plant will be disposed of in an engineered landfill (Monenco, 1987).

One important source of potential emissions to the atmosphere is the incinerator stack. Emissions will include acid gases, such as sulphur dioxide, nitrogen oxides and hydrogen chloride, trace metals, various organic compounds and particulate matter. As well, the evaporator stack is expected to emit certain organic compounds. Fugitive emissions released at or near ground level can be expected from other components of the facility. These will include low levels of volatile organics released from liquid waste handling, storage and distribution, and the physical/chemical treatment plant. Fugitive emissions of particulate matter can also be expected. Some potential sources are: physical/chemical treatment, incinerator ash handling, landfilling, vehicular traffic and construction activities.

These potential emissions are the focus of the following assessment of existing air quality, and were one criterion used in the selection of monitoring parameters.

3.3.3 EXISTING DATA FOR NIAGARA PENINSULA

In a previous report (ORF, 1984a), data from several Ministry of the Environment (MOE) monitoring stations were used to represent the ambient air quality in and around the Niagara Peninsula. This work has been updated to include the latest monitoring data available from the MOE (up to 1985). Detailed tables giving the annual means, maxima and the number of exceedances of applicable air quality criteria, including those for sulphur dioxide (SO_2), total reduced sulphur (TRS), total suspended particulate (TSP), nitrogen oxides (NO_x), ozone (O_3) and hydrocarbons for pertinent sites in the Niagara peninsula over the period 1980 to 1985, are presented in Appendix H. Table 3.11 summarizes the data for the latest year available (1985). Several of the stations are representative of only small local areas near known industrial sources of air pollution (for example, in Chippawa and Thorold). The remaining recording stations are situated in relatively rural locations generally some distance from large local sources, but are subject to long range

TABLE 3.11

Annual Mean Levels of Pollutants
Measured at MOE Stations in the Niagara Peninsula in 1985

Concentrations ($\mu g/m^3$)

Station	SO_2	TRS	TSP	Soiling Index COH/1000 ft	Dustfall g/m^2/ 30 days	NO	NO_2	NO_x	CH_4	RHC*	O_3	CO
Big Creek	-	-	32	-	-	-	-	-	-	-	-	-
Chippawa												
(005)	-	-	-	-	6.7	-	-	-	-	-	-	-
(006)	-	-	-	-	2.8	-	-	-	-	-	-	-
(009)	-	-	-	-	-	-	-	-	-	-	-	-
(014)	-	-	44	-	-	-	-	-	-	-	-	-
(051)	13	3	27	-	-	-	-	-	-	-	-	-
Dogs Nest	-	-	-	-	-	-	-	-	-	-	-	-
Fort Erie	10	-	-	-	-	-	-	-	-	-	-	-
Greensville												
(073)	-	-	-	-	14.2	-	-	-	-	-	-	-
(074)	-	-	-	-	11.2	-	-	-	-	-	-	-
(075)	-	-	-	-	8.6	-	-	-	-	-	-	-
(076)	-	-	-	-	6.4	-	-	-	-	-	-	-
(096)	-	-	-	-	6.2	-	-	-	-	-	-	-
(097)	-	-	-	-	5.2	-	-	-	-	-	-	-
Jarvis												
(087)	-	-	49	-	-	-	-	-	-	-	-	-
(092)	-	-	37	-	-	-	-	-	-	-	-	-
(960)	-	-	34	-	-	-	-	-	-	-	-	-
(965)	-	-	33	-	-	-	-	-	-	-	-	-
Long Point	5	-	-	-	-	0	8	6	-	-	67	-
Nanticoke												
(086)	8	.4	32	-	3.8	1	6	8	1061	46	-	-
(904)	5	.3	27	-	-	-	-	-	1061	39	-	-
(907)	-	1.5	59	-	-	-	-	-	-	-	-	-
(961)	-	-	45	-	-	-	-	-	-	-	-	-
(964)	-	-	39	-	-	-	-	-	-	-	-	-

TABLE 3.11 (contd.) Annual Mean Levels of Pollutants Measured at MOE Stations in the Niagara Peninsula in 1985

Concentrations ($\mu g/m^3$)

Station	SO_2	TRS	TSP	Soiling Index COH/1000 ft	Dustfall g/m^2/ 30 days	NO	NO_2	NO_x	CH_4	RHC*	O_3	CO
Niagara Falls												
(053)	-	-	67	-	-	-	-	-	-	-	-	-
(055)	16	2	79	.33	-	-	-	-	-	-	-	-
(056)	8	-	44	.20	-	-	-	-	-	-	-	-
(156)	13	-	-	.26	-	-	-	-	-	-	-	-
Peacock Provincial Park	-	-	26	-	-	-	-	-	-	-	-	-
Pt. Colborne												
(030)	-	-	43	-	-	-	-	-	-	-	-	-
(047)	-	-	49	-	-	-	-	-	-	-	-	-
Pt. Dover	-	-	32	-	-	-	-	-	-	-	-	-
Simcoe	13	-	31	.16	-	5	11	19	-	143	61	-
St. Cath.												
(037)	16	-	50	.26	-	11	32	142	-	-	35	229
(059)	-	-	59	-	-	-	-	-	-	-	-	-
(060)	-	-	65	-	-	-	-	-	-	-	-	-
(137)	16	-	-	.30	-	-	-	-	-	-	-	-
Thorold												
(042)	13	-	-	-	7.7	-	-	-	-	-	-	-
(043)	-	-	-	-	3.9	-	-	-	-	-	-	-
(052)	44	4	106	.29	-	-	-	-	-	-	-	-
Townsend	8	-	36	-	-	-	-	-	-	-	-	-
Welland												
(045)	-	-	48	-	-	-	-	-	-	-	-	-
(025)	-	-	-	-	4.8	-	-	-	-	-	-	-
(026)	-	-	-	-	4.9	-	-	-	-	-	-	-
(035)	-	-	-	-	7.4	-	-	-	-	-	-	-

Notes:
* As methane

SO_2 - sulphur dioxide
TRS - total reduced sulphur
TSP - total suspended particulates
COH - coefficient of haze

DF - dustfall
NO - nitrogen oxide
NO_2 - nitrogen dioxide
NO_x - nitrogen oxides

RHC reactive hydrocarbons
O_3 - ozone
CO - carbon monoxide
CH_4 - methane

transport from sources many tens or hundreds of kilometres away. They are, therefore, more representative of the West Lincoln area. Annual average ranges measured during the years 1980-1985 at the more rural stations in the Niagara Peninsula are summarized in Table 3.12.

A simulation of air quality across the area, based on dispersion modelling and a source emissions inventory (ORF, 1984a) was used to estimate the expected levels in areas where there were no monitoring stations. The air quality monitoring data collected for the 1980, 1981 and 1982 periods were used to validate the modelling results. Isopleths of annual average concentrations of SO_2, TSP, NO_x and total hydrocarbons (THC) were prepared from the model results and are presented in Figures 3.10 to 3.13. It is important to note that the model only accounted for anthropogenic sources. Natural sources and long range transport of material into a region could account for an additional 80 percent for THC and approximately 50 percent for TSP. The model predicted the following annual levels for the West Lincoln area: SO_2, 10 $\mu g/m^3$; TSP, 19 $\mu g/m^3$; NO_x, 20 $\mu g/m^3$; and THC, 32 $\mu g/m^3$.

3.3.4 GENERAL AMBIENT AIR CONCENTRATIONS

Due to the limitations of the existing monitoring networks, concentration data are lacking for many components for which air quality standards and guidelines exist, including many components which have been identified as potential air emissions from the OWMC facility. Consequently, a comprehensive literature review was undertaken with the objective of providing a general definition of the the concentrations of various trace constituents that could be expected to occur in typical urban, rural and remote regions of the world. The data have been compiled (see Appendix I) in terms of specific organic compounds, acid gases, metals and "other" contaminants. The tabulated data may not represent exact levels of concentrations experienced in West Lincoln, but do provide a general indication of the potential occurrence of these individual contaminants and an order of magnitude which can be expected. It should,

TABLE 3.12

Annual Average Ranges Measured at MOE Stations in the Niagara Peninsula, 1980-1985

Pollutant	Concentration Ranges ppm	Concentration Ranges $\mu g/m^3$
Sulphur dioxide (SO_2)	.002 to .01	5.2 to 26.
Total Suspended Particulate (TSP)		26. to 59.
Total Reduced Sulphur (TRS (H_2S))	.0001 to .0011	.14 to 1.5
Soiling Index	.11 to .16 Coefficient of Haze per 1000 ft	
Dustfall (DF)	2.3 to 14.5 g/m^2/30 days	
Nitric Oxide (NO)	.000 to .009	0. to 11.
Nitrogen Dioxide (NO_2)	.003 to .014	5.6 to 26.
Nitrogen Oxides (NO_x)	.003 to .018	5.6 to 34.
Total Hydrocarbons THC (as CH_4)	1.6 to 2.3	1042 to 1498
Ozone (O_3)	.024 to .034	47. to 67.
Carbon Monoxide (CO)	.1 to .2	114 to 229

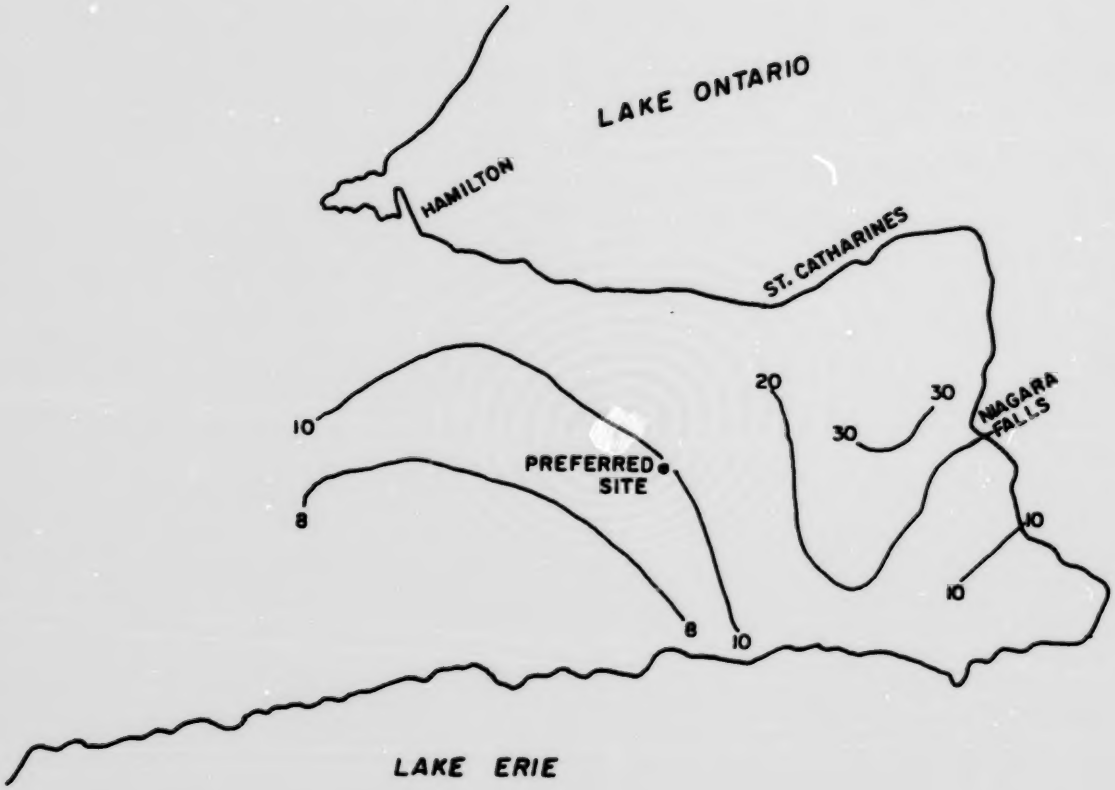


FIGURE 3.10
ANNUAL CONCENTRATIONS OF SULPHUR DIOXIDE
MODEL RESULTS

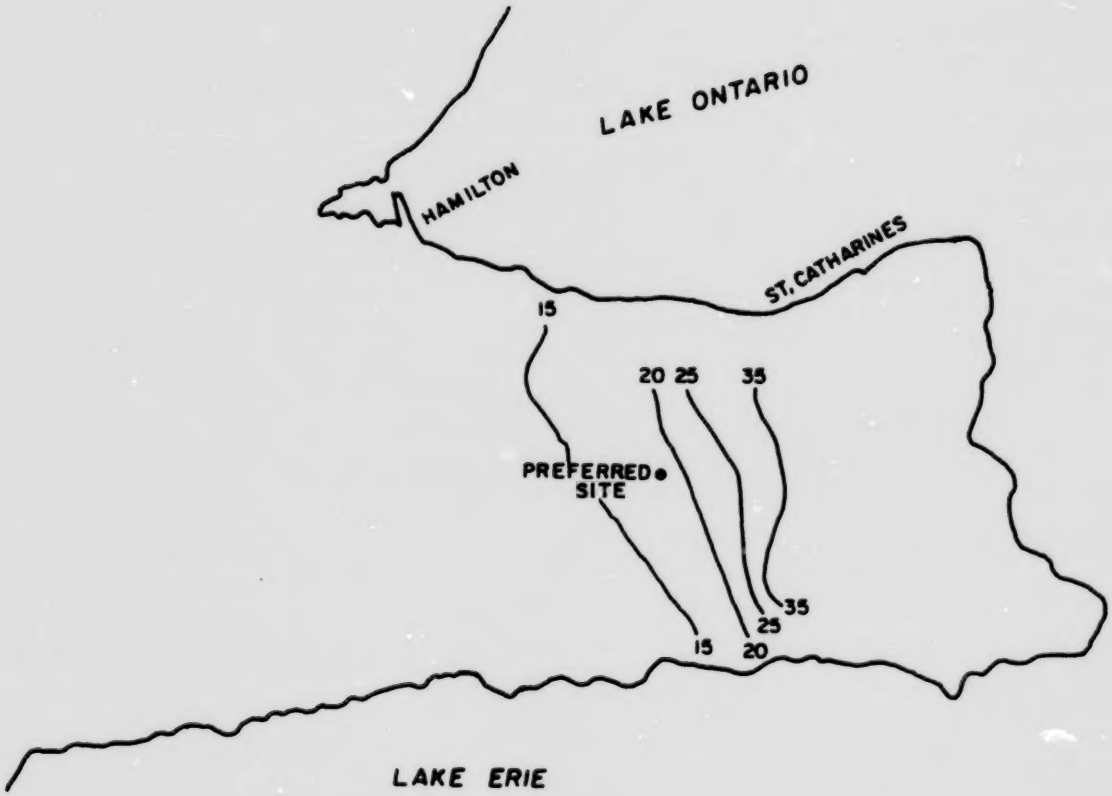


FIGURE 3-11

ANNUAL CONCENTRATIONS OF TOTAL SUSPENDED PARTICULATE MATTER
MODEL RESULTS

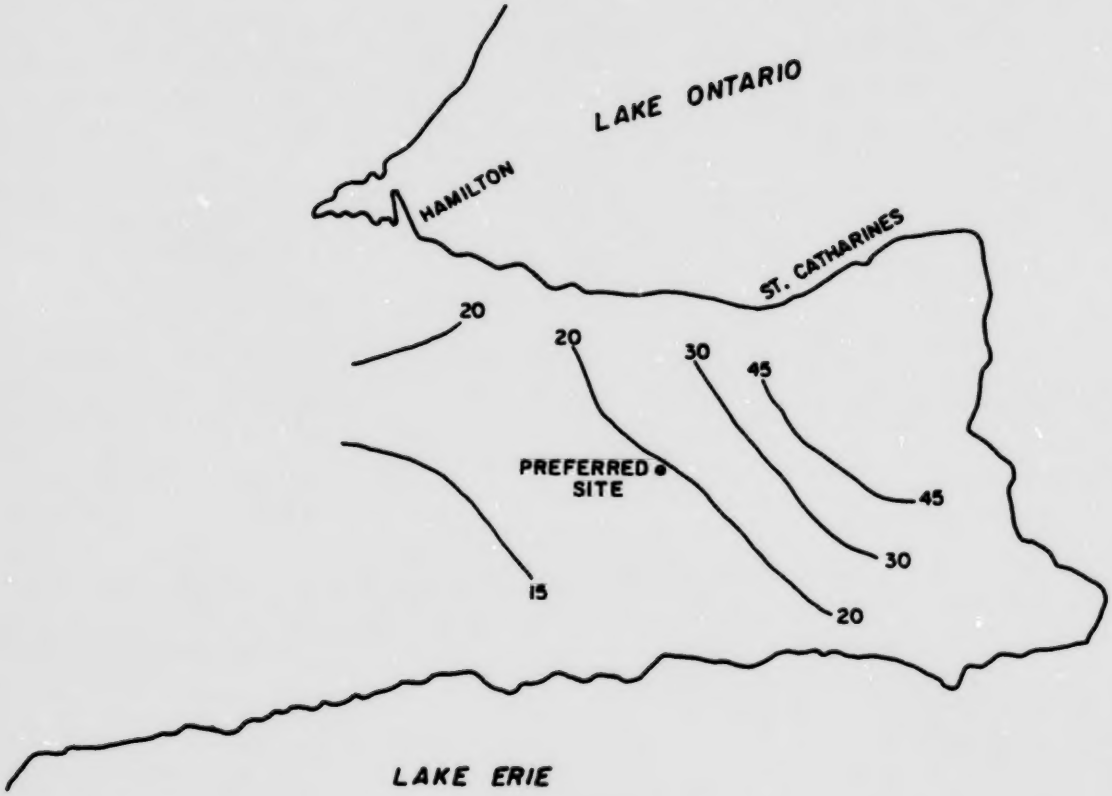


FIGURE 3.12

ANNUAL CONCENTRATIONS OF NITROGEN OXIDES
MODEL RESULTS

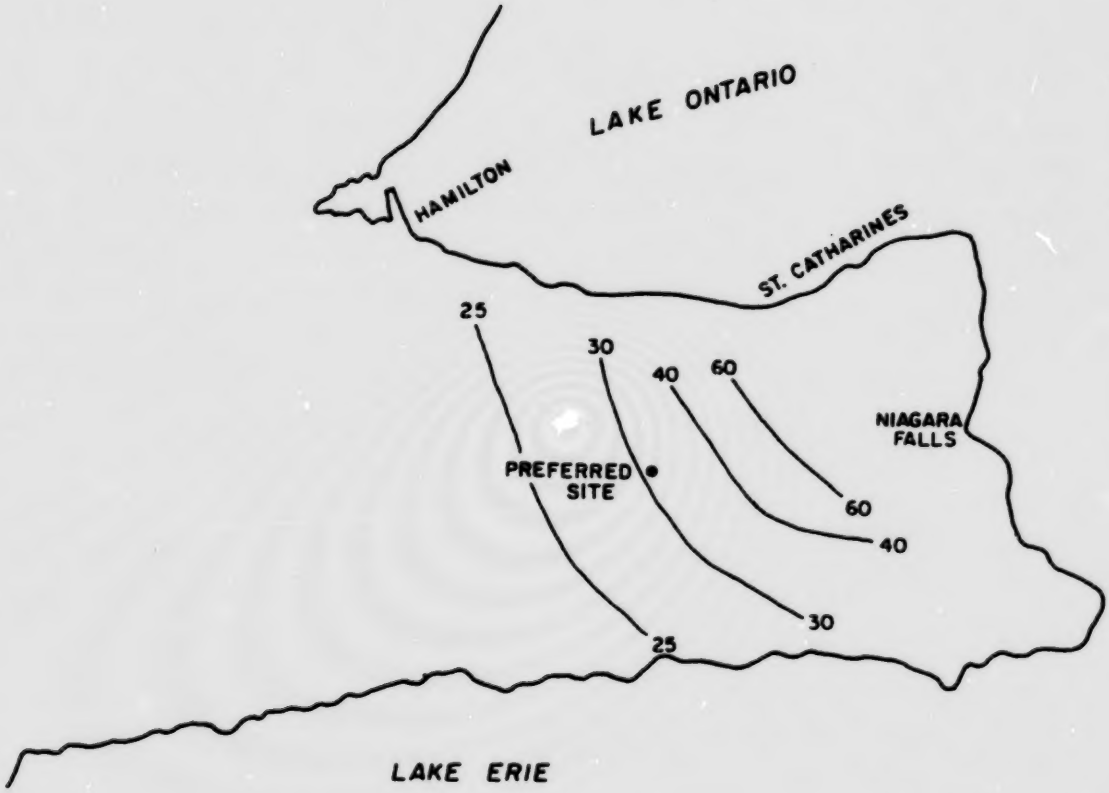


FIGURE 3.13
ANNUAL CONCENTRATIONS OF TOTAL HYDROCARBONS
MODEL RESULTS

however, be noted that some of the values listed in Appendix I represent only a single 24-hour sample, and that there are variations in sampling methodologies used.

3.3.5 BASELINE MONITORING PROGRAM

To supplement the above information, background air quality conditions were monitored at the OWMC site in West Lincoln for a period of one year (June 1986 - May 1987). The air quality and meteorological monitoring station is located in the southwest corner of the site as illustrated in Figure 3.1. Data for the following air quality parameters were collected:

- Sulphur dioxide (SO_2 - continuously),
- Nitrogen oxides (NO, NO_2, NO_x - continuously),
- Ozone (O_3 - continuously),
- Total reduced sulphur (TRS - continuously),
- Total hydrocarbons (THC - continuously),
- Total suspended particulate (TSP) and fine particulate (FP) (every 3rd day for 24 hours),
- Wet deposition for trace metals (As, Be, Cd, Cr, Cu, Fe, Pb, Ni, Zn) (monthly composite sample),
- Trace organic and inorganic constituents (fluorides, chlorides, cyanide, mercury, PCB's, chlorophenols, chlorobenzenes, pesticides, herbicides, PAH's and dioxins) every 18th day for 24 hours, and

- Trace metals associated with particulate matter (Al, As, B, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, K, Mg, Mn, Mo, Na, Ni, P, Pb, Sb, Se, Si, Sn, Te, V, Zn) (every 18th day for 24 hours).

In addition, a Trace Atmospheric Gas Analyzer (TAGA), a mobile dual mass spectrometer instrument, was used on occasion during the first three seasons to obtain a background scan of numerous atmospheric trace organic constituents.

In the case of the continuous monitoring, gas analyzers were located inside a trailer and outside air was sampled through a glass manifold inlet. Particulate measurements were made on the roof of the trailer, as were deposition measurements. The continuous monitors were connected to a remote data collection unit and results were telemetered to ORF on a daily basis for processing. Particulate, deposition and trace organic/inorganic cumulative sampling devices required manual installation and removal of collection media and subsequent laboratory analysis. Further details on the monitoring techniques can be found in Appendix E.

3.3.6 RESULTS OF BASELINE MONITORING

The pollutants which were measured continuously or routinely at the monitoring site are sulphur dioxide, nitrogen oxides and ozone, total reduced sulphur, total hydrocarbons and both total and fine particulates. Table 3.13 summarizes the ranges of hourly values and seasonal means recorded at the site during the baseline monitoring for these pollutants.

The results of the cumulative (every 18 days) sampling at the site are summarized in Table 3.14 in the form of ranges of values for the element, compound or compound group (for example, PCB's are presented as total PCB's although various congeners were quantified in the analysis). Sampling was undertaken for fluorides, chlorides, cyanide, mercury,

TABLE 3.13

Summary of On-Site Baseline Monitoring Results for Continuously Monitored Gaseous and Particulate Pollutants

Concentrations ($\mu g/m^3$)

Pollutant	Summer Range of Hourly Values	Summer Seasonal Mean*	Fall Range of Hourly Values	Fall Seasonal Mean	Winter Range of Hourly Values	Winter Seasonal Mean	Spring Range of Hourly Values	Spring Seasonal Mean	Annual Range of Hourly Values	Annual Seasonal Mean
SO_2	0-235	10	0-173	12	0-139	16	0-277	12	0-277	12
NO	0-49	2	0-108	2	0-146	3	0-29	2	0-146	2
NO_2	0-62	7	0-101	19	0-107	30	4-107	24	0-107	21
NO_x	0-75	9	0-250	20	0-300	36	4-126	26	0-300	23
O_3	0-196	62	0-237	44	0-96	41	0-208	73	0-237	56
TRS	0-6	<1	0-4	<1	0-4	<1	0-3	<1	0-6	<1
THC (as CH_4)	485-2223	1083	553-1995	1140	NA	NA	NA	NA	NA	NA
TSP**	11-102	35	8-62	26	12-56	25	8-123	30	8-123	29
FP**	7-87	26	7-48	21	6-56	21	5-56	20	5-87	22

Notes:

NA = Not Available

* Arithmetic Mean

**Geometric Means used for TSP and FP averages

TABLE 3.14

Summary of Cumulative Sampling Results from the Baseline Monitoring Program

(Concentrations in ng/m^3 for air samples; µg/l for rainwater samples)

Pollutant	Summer 1986	Fall 1986	Winter 1986-87	Spring 1987	Annual
Fluorides	nd-300.	nd-1460.	nd-90.	nd-20.	nd-1460.
Chlorides	nd-940.	nd-780.	nd-1590.	37.-1550.	nd-1590.
Cyanides	nd	NA	NA	NA	nd
Mercury (total)	nd	nd-1.9	nd-1.5	nd-20.5	nd-20.5
PCBs (total)	nd	nd-.045	nd-.073	.004	nd-.073
Chlorobenzenes	nd-.91	nd-.83	nd-1.84	nd-1.06	nd-1.84
Chlorophenols	nd	nd	nd	nd	nd
Pesticides	nd-.024	nd-.144	nd-.108	nd-.107	nd-.144
Herbicides	nd	nd	nd	nd-40.	nd-40.
Dioxins	NA	nd-.00039	NA	NA	nd-.00039
Furans	NA	nd-.00022	NA	NA	nd-.00022
PAH's*	25.0-83.9	5.4-18.9	9.5-25.9	2.7-40.5	2.7-83.9
<u>Rainwater Trace Metals</u>					
As	nd	nd	nd	nd	nd
Be	nd	nd	nd	nd	nd
Cd	nd-1.2	nd	nd	nd	nd-1.2
Cr	nd-18.5	nd	nd-3.7	nd-.9	nd-18.5
Cu	nd-3.0	nd-4.6	1.3-14.6	nd-7.2	nd-14.6
Fe	27.8-226.8	6.8-46.8	20.6-128.8	33.7-269.7	6.8-269.7
Ni	nd	nd	nd	nd-5.5	nd-5.5
Pb	nd	nd	nd-12.5	nd-5.5	nd-5.5
Zn	16.5-19.5	7.5-18.5	18.0-208.5	nd-83.8	nd-208.5

TABLE 3.14 (Contd.)

Summary of Cumulative Sampling Results from the Baseline Monitoring Program

(Concentrations in ng/m^3 for air samples; µg/l for rainwater samples)

Pollutant	Summer 1986	Fall 1986	Winter 1986-87	Spring 1987	Annual
TSP Trace Metals					
Al	11.3-17.9	32.7-73.5	7.7-91.9	.4-138.	.4-179.
As	nd-.4	nd	nd-1.9	nd-.6	nd-1.9
B	nd-6.2	nd-3.4	1.7-10.9	nd-8.3	nd-10.9
Be	nd	nd	nd	nd	nd
Bi	nd	nd	nd	nd	nd
Ca	118.-671.	119.-484.	37.5-631.	nd-759.	nd-759.
Cd	nd-1.3	nd	nd	nd	nd-1.3
Co	nd	nd	nd-1.9	nd	nd-1.9
Cr	nd	nd-1.3	nd-1.2	nd-1.4	nd-11.1**
Cu	.7-25.6	2.5-12.1	nd-25.1	1.4-6.9	nd-25.6
Fe	47.2-239.	90.2-113.	31.6-140.	12.9-158.	12.9-531.**
K	nd-102.	nd	nd	nd	nd-102.
Mg	43.4-227.	34.1-107.	11.2-211.	nd-232.	nd-232.
Mn	nd-8.5	3.2-8.0	nd-8.1	nd-9.3	nd-9.3
Mo	nd	nd	nd	nd	nd
Na	nd-72.	nd-314.	nd-356.	nd-196.	nd-356.
Ni	nd	nd-1.0	nd-2.1	nd-2.6	nd-5.5**
P	nd	nd	nd	nd	nd
Pb	nd-13.4	5.2-15.6	nd-20.8	nd-4.8	nd-23.0**
Sb	nd-.2	nd-.5	nd-.2	nd-.2	nd-.2
Se	nd-.6	nd-2.1	nd-1.5	nd-5.8	nd-5.8
Si	nd-184.	nd-83.0	nd-119.	nd-158.	nd-184.
Sn	nd-2.3	nd	nd-6.7	nd-11.7	nd-11.7
Te	nd-.4	nd	nd-.5	nd-.2	nd-.5
V	nd	nd	nd	nd-1.4	nd-1.4
Zn	5.7-13.4	11.5-29.4	nd-23.5	nd-17.7	nd-29.4

TABLE 3.14 (Contd.)

Summary of Cumulative Sampling Results from the Baseline Monitoring Program

(Concentrations in ng/m^3 for air samples; µg/l for rainwater samples)

Pollutant	Summer 1986	Fall 1986	Winter 1986-87	Spring 1987	Annual
FP Trace Metals					
Al	35.5-69.5	11.2-52.2	nd-41.4	28.0-91.7.	nd-91.7
As	nd-.4	nd-.3	nd-2.6	nd-1.5	nd-2.6
B	nd-19.5	nd-4.1	1.1-8.7	.9-11.5	nd-19.5
Be	nd	nd	nd	nd	nd
Bi	nd-26.2	nd-18.5	nd	nd-14.0	nd-26.2
Ca	53.2-275.	73.9-133.	nd-152.	93.0-305.	nd-305.
Cd	nd-0.4	nd	nd	nd	nd-0.4
Co	nd	nd	nd	nd-1.2	nd-1.2
Cr	nd-1.6	nd-1.2	nd-1.2	nd-1.8	nd-1.8
Cu	2.6-14.2	nd-2.3	nd-4.1	nd-7.8	nd-14.2
Fe	25.8-164.	34.1-86.2	nd-68.1	34.3-121.	nd-164.
K	nd-65.8	nd	nd	nd-27.4	nd-65.8
Mg	19.9-108.	18.4-32.3	3.1-35.2	30.7-81.3	3.1-108.
Mn	1.5-8.6	1.3-7.5	1.0-3.0	1.6-6.0	nd-8.6
Mo	nd	nd	nd	nd	nd
Na	nd-187.	nd-96.	nd-106.	nd	nd-187.
Ni	nd-1.5	nd-1.8	nd-.7	nd-2.8	nd-2.8
P	nd-108.	nd	nd	nd	nd-108.
Pb	nd-33.2	4.7-23.4	nd-10.9	nd-16.2	nd-33.2
Sb	nd-.6	nd-.6	nd-.2	nd-.3	nd-0.6
Se	nd-2.1	nd-2.4	nd-2.5	nd-5.0	nd-5.0
Si	34.8-99.5	nd-65.6	nd-60.1	nd-74.6	nd-99.5
Sn	nd	nd-1.3	nd-11.1	nd	nd-11.1
Te	nd-.5	nd	nd-.2	nd-.8	nd-.8
V	nd	nd-2.0	nd	nd-5.0	nd-5.0
Zn	5.6-27.0	4.9-32.8	nd-12.8	2.3-19.0	nd-32.8

Notes:
* Total of 13 PAH's measured
** Spring 1986
nd - not detected
NA - not available
\- range shown

PCB's, chlorobenzenes, chlorophenols, herbicides, pesticides, dioxins, PAH's and trace metals.

Sampling by the mobile TAGA was carried out at the meteorological station and at the corner of Schram Road and Highway 20 during the spring, summer and fall seasons of 1986. From the scans of up to 70 compounds, only benzene and toluene were detected at the Schram Road site (4 and 5 ppb, respectively, in the Spring of 1986).

Appendix F contains the detailed results of the baseline monitoring, including the reports from the TAGA surveys.

3.3.7 SYNTHESIS OF SITE AIR QUALITY

Table 3.15 compares the pollutants measured at the OWMC preferred site with Ontario Air Quality Criteria. As well, rural levels measured by the MOE (summarized in Appendix H), or found in the literature (Appendix I) are listed for comparison. The only exceedances of criteria measured at the preferred site were for total particulate matter and ozone. The latter is a common occurrence in all parts of Southern Ontario, especially on hot hazy days. Suspended particulate levels exceeded the criterion on one occasion. The remaining pollutants were measured at levels much less than their allowable limits in most cases, and were generally of the same orders of magnitude as those measured at other rural sites (where data was available). Generally, low concentrations of most air pollutants were found at the OWMC preferred site.

3.4 CONCLUSION

The existing air quality and meteorological conditions at the OWMC preferred site were measured, analyzed and interpreted over a period of one year (June 1986 to May 1987). The meteorological data confirmed the prevailing southwesterly winds in the area, and it was found that wind

TABLE 3.15

Comparison of On-Site Baseline Air Quality Results
and Other Published Rural Values with
Ontario Air Quality Criteria

(concentrations in $\mu g/m^3$)

Pollutant	Criterion		Averaging Time	Max. Value at OWMC Site	MOE Max. Measured Values (rural) (App. H)	Values from Literature (rural) (App. I)
Antimony	25.	(1)	24-h	.0006	NA	.001-.15
Arsenic	25.	(2)	24-h	.0026	NA	.0002-.33
Benzene	3300.	(1)	24-h	16. (1-hr)	NA	.7-7.
Benzo(a)Pyrene	.0011	(1)	24-h	.00049	NA	.000144
Beryllium	.01	(1)	24-h	<.00025	NA	NA
Boron	100.	(1)	24-h	.02	NA	NA
Cadmium	2.	(2)	24-h	.0013	.043	.0004-1.
Chlordane	5.	(1)	24-h	.0001	NA	.00001-.00005
Chromium	1.5	(1)	24-h	.011	.024	.001-201.
Dioxins	.00003	(1)	Annual	.00000039	NA	NA
Copper	50.	(1)	24-h	.026	3.43	.029-.65

TABLE 3.15 (contd.)

Comparison of On-Site Baseline Air Quality Results
and Other Published Rural Values with
Ontario Air Quality Criteria

(concentrations in $\mu g/m^3$)

Pollutant	Criterion		Averaging Time	Max. Value at OWMC Site	MOE Max. Measured Values (rural) (App. H)	Values from Literature (rural) (App. I)
Fluorides Gaseous (Apr. 15 - Oct. 15)	0.86	(2)	24-h	.08	NA	NA
Fluorides Total (Apr. 15 - Oct. 15)	1.72	(2)	24-h	.34	NA	<.05(remote)
(Oct. 16 - Apr.14)	3.44	(2)	24-h	1.46	NA	.01-13.2(urban)
Iron	4.	(1)	24-h	.53*	11.8	<.002-14.5
Lead	5.	(2)	24-h	.033	1.0	nd - .80
Manganese	10.	(1)	24-h	.0093	1.04	nd - .23
Mercury	2.	(2)	24-h	.02	NA	.002-.007
Methyoxychlor	100.	(1)	24-h	nd	NA	NA
Nickel	2.	(2)	24-h	.0055*	.111	.003-.14
Nitric Oxide	9000.	(1)	24-h	36.	73.	NA
Nitrogen Dioxide	400.	(2)	1-h	107.	263.	NA
	200.	(2)	24-h	62.	94.	NA
Nitrogen Oxides	200.	(1)	24-h	114.	207.	NA

TABLE 3.15 (contd.)

Comparison of On-Site Baseline Air Quality Results
and Other Published Rural Values with
Ontario Air Quality Criteria

(concentrations in $\mu g/m^3$)

Pollutant	Criterion		Averaging Time	Max. Value at OWMC Site	MOE Max. Measured Values (rural) (App. H)	Values from Literature (rural) (App. I)
Ozone	165.	(2)	1-h	237. (1-hr)	266. (1-hr)	33.-72.
Pentachlorophenol	20.	(1)	24-h	<.005	NA	.00025-.0073 (urban)
PCB's	.15	(1)	24-h	.00007	NA	.0001-.023
Selenium	10.	(1)	24-h	.0058	NA	.00095-.02
Sulphur Dioxide	690.	(2)	1-h	277.	916.	NA
	275.	(2)	24-h	72.	209.	5.8-24.
	55.	(2)	Annual	12.	26.	NA
Tellurium	10.	(1)	24-h	.0008	NA	NA
Tin	10.	(1)	24-h	.0012	NA	.000058
Toluene	2000.	(1)	24-h	15. (1-hr)	NA	1.9-12.
Total Reduced Sulphur (as H_2S)	30.	(2)	1-h	5.6 (1-h)	125. (1-h)	.0008-.0065 (remote)

TABLE 3.15 (contd.)

Comparison of On-Site Baseline Air Quality Results
and Other Published Rural Values with
Ontario Air Quality Criteria

(concentrations in $\mu g/m^3$)

Pollutant	Criterion		Averaging Time	Max. Value at OWMC Site	MOE Max. Measured Values (rural) (App. H)	Values from Literature (rural) (App. I)
Total Suspended Particulate	120.	(2)	24-h	123.	494.	NA
	60.	(2)	Annual	29.	59.	20.-60.
1,2,4-Trichloro-benzene	400.	(1)	24-h	.0018	NA	nd-.867 (urban)
Vanadium	2.	(1)	24-h	.005	.073	.001-.097
Zinc	100.	(1)	24-h	.033	.2	<.0006-4.6

Notes

nd not detected
NA not available
* from Spring 1986
(1) 24-h criterion which is basis for Ontario standard or guideline (see Appendix A)
(2) Criterion included in Ontario Regulation 296 (see Table 2.1)

speeds were generally lower than measured at nearby airports. A site climatology was formulated representing long-term meteorological (dispersion) conditions at the site (based on a detailed comparison with other long-term meteorological stations). It was discovered that the north winds tended to coincide with the more unstable conditions, while southwest winds prevailed under the more stable and neutral conditions.

Air quality parameters of interest to the OWMC analysis were measured either continuously or sequentially on-site during the one-year study. Results were as expected for a rural location, i.e., the majority of pollutants were well below the Ontario Air Quality Criteria with the exceptions of ozone and total suspended particulate. These pollutants commonly exceed their criteria in rural areas of Southern Ontario as a result of long-range transport (ozone) and agricultural activities (TSP).

The baseline meteorological and air quality data are necessary inputs into the analysis of the effects of construction and facility operations on the existing air environment, as discussed in the following Chapters 4 and 5.

Further monitoring of selected meteorological and air quality parameters is continuing at the OWMC site. As well, an additional intensive monitoring program was conducted in August and October 1987. The results of these surveys will be documented in later reports.

4. EFFECTS OF CONSTRUCTION

4.1 INTRODUCTION

Construction of the OWMC facility may generate emissions to the atmosphere which have the potential to create a temporary impact on local air quality. Dust generated from a variety of open sources is the main concern. Such fugitive emissions can arise from construction activities such as land clearing, blasting, ground excavation, cut and fill operations and the erection of buildings or other components of the facility. Fugitive dust generation is caused by two basic physical phenomena:

- pulverization and abrasion of surface materials by application of mechanical force through implements, and

- entrainment of dust particles by air currents, such as wind erosion of an exposed surface.

Dust emissions can vary substantially from day-to-day and hour-to-hour depending on the level of activity, the specific operations, and the prevailing weather. The large dust particles settle out near the source, while the fine particles are dispersed over much greater

distances from the source. Often a large portion of the emissions result from equipment traffic over temporary roads at a construction site (USEPA, 1985). Vehicle exhaust emissions of particulate matter generally contribute very little to the ambient levels, and are considered a minor concern relative to other sources.

Control techniques for fugitive dust sources, such as construction sites, can include watering, chemical stabilization or reduction of surface wind speed with windbreaks or enclosures. Watering is the most common and least expensive method but provides only temporary control unless constantly applied. The application of chemicals involves the risk of contaminating surrounding ecosystems. Windbreaks and enclosures are often not practical due to the size of the fugitive dust sources (USEPA, 1985).

This chapter includes emission estimates for all significant sources of emission during construction of the OWMC facility, and the effects of such emissions on the ambient air quality over the short-term (1-hour), seasonal (summer) and annual time periods. Compliance with standards and regulations are discussed, as well as means of mitigation and proposals for monitoring during construction. It must be emphasized that there are large uncertainties involved in such fugitive emissions calculations because of the many assumptions and estimates involved.

4.2 EMISSION ESTIMATES

4.2.1 OFF-SITE VEHICLE EMISSIONS

It has been assumed in this analysis that all off-site roads will be paved before the site construction commences. Dust emissions from paved roads vary with the volume of traffic, road surface silt content, surface dust loading, and the average weight of vehicles travelling on the road. Airborne dust may be generated by any construction vehicles

leaving the site if earth and other construction materials are tracked onto the paved road from the unpaved roads on-site. As well, exhaust related emissions can be expected to increase somewhat in the vicinity of the off-site roads during construction.

The construction schedule was reviewed and the average daily vehicle traffic related to construction of the OWMC facility was estimated to be 485 car trips (both directions) and 45 truck deliveries (Monenco, 1986). This traffic was compared to the predicted number of vehicles which would otherwise be travelling along Highway 20 in the year 1990, (i.e., 560 trucks/day and 2940 cars/day (both directions)) (see Appendix J).

Dust emission factors for paved roads were used to calculate emission rates. These emission rates are provided in Appendix J, along with emission rates of carbon monoxide (CO), hydrocarbons (HC) and nitrogen oxides (NO_x) from vehicle exhaust.

4.2.2 ON-SITE EMISSIONS

Dust emissions from unpaved roads have been found to vary with the volume of traffic, average vehicle speed, average vehicle weight, average number of wheels per vehicle, road surface texture, road surface moisture and the fraction of silt in the road surface materials. When a vehicle travels on an unpaved road, the force of the wheels on the road surface causes pulverization of surface material. Particles are lifted and dropped from the rolling wheels and some of the finer particles remain suspended after the vehicle has passed (USEPA, 1985).

Peak hourly and mean annual vehicle movements and types were obtained from the construction plans for the June, and January to December periods, respectively (Monenco, 1986). Empirical equations (given in Appendix J) were used to calculate unpaved road dust emission rates for each source due to vehicles involved in the three main construction areas: the berm, the storm water pond and the central

operating area. It was assumed that normal watering and/or other dust suppression measures would be 90 percent effective in reducing unpaved road dust emissions.

In addition to the road dust contribution, further airborne particulate emissions may arise from several distinct activities within the site e.g., the handling, loading and unloading of excavated materials. When freshly dug soils are loaded into a pile, or truck, the potential for dust emissions can be significant, depending on several conditions at the time of the transfer. Fines are easily disaggregated and released to the atmosphere upon exposure to air currents from the transfer itself or local winds. The quantity of dust emissions depends on the silt content of the soil, material moisture content, mean wind speed, the drop height and the dumping device capacity (USEPA, 1985).

The construction of the berm is expected to require the use of several scrapers and bulldozers, and a grader. As each piece of equipment disturbs the soil, varying amounts of dust are created, depending on the following major factors: scrapers - silt content of soil and mean vehicle weight; bulldozers - silt content and material moisture content; graders - mean vehicle speed (USEPA, 1985).

From the time an area is disturbed until new vegetation emerges, all disturbed surfaces are subject to wind erosion. Wind erosion is influenced by soil silt content, surface soil moisture, and the wind speed at the site. Worst case emissions from storage piles occur under dry, windy conditions. However, various control methods may be applied, achieving up to 90 percent control efficiency (USEPA, 1985). In this assessment, wind erosion was considered in the seasonal and annual analyses. The short-term worst case corresponds to low wind speed conditions, during which the contribution due to wind erosion is not expected to be significant.

The emission factor equations for dust from unpaved roads, materials handling, wind erosion and equipment activities, along with the

assumptions used in calculating the emission factors are given in Appendix J. Estimated emission rates for each activity are also given.

The summer emission rates are slightly greater than the mean annual values due to the more intense activity planned for this season. The short-term (hourly) emission rates are higher than the long-term rates, and each are influenced by different factors. At the central operating area, the greatest contribution to the short-term emissions is from road emissions, and especially from construction vehicles. The long-term emissions are mainly determined by a combination of the soil erosion factor and by road emissions. At the berm the dominant emission factor is due to the movement of construction vehicles. Soil erosion by the wind is not anticipated to be as significant a factor at the berm due to the smaller areas which will be exposed at any given time. Table J-1 in Appendix J presents the emission rates for each individual activity within the three areas.

4.3 EFFECTS ON AMBIENT AIR QUALITY

4.3.1 DISPERSION OF EMISSIONS

In dealing with the dispersion of fugitive emissions in an area containing a large number of potential sources, as at a construction site, it is not possible to consider all sources individually. Accordingly, all of the emissions within a given area were combined and treated as an area source. The off-site emissions attributable to vehicle traffic were treated as line sources.

The dispersion of emissions over a one-hour period was modelled using the assumptions of a Gaussian distribution for plume spread, and the Pasquill-Gifford equations (see Appendix K). Pasquill Stability Class D (neutral) was assumed with a relatively low windspeed (3 m/s) to represent moderately adverse dispersion conditions consistent with the construction schedule (e.g., during daylight hours). The dispersion of

fugitive dust is different from that of a continuously emitting point source, especially in the case of wind erosion, requiring minimum wind speeds of near 3 m/s to become entrained. Vehicle related emissions, however, are independent of wind speed. To simulate "worst-case" conditions for these mobile sources, F stability and winds of 1 m/s were assumed.

Construction activity in the central operating area was treated as a 450 x 1000 m area source and included the surface water and fire water pond construction. The berm construction was treated as a 900 x 100 m area source, while the storm water pond construction was treated as a 300 x 100 m area source. These areas are larger than the actual areas designated for the "finished" facilities, in order to more accurately represent the area being disturbed during construction. Off-site vehicle emissions from Highway 20 were calculated using a Gaussian plume model adapted for a line source. Appendix J contains the details of the input data used, while the details of the dispersion models used are presented in Appendix K.

The general location and configuration of the construction areas within the site are shown in Figure 4.1. It was determined that the critical receptors in this case (i.e., those likely to experience the highest concentrations) are directly opposite the berm along Highway 20. They are potentially exposed to overlapping plumes from the berm, central operating area and storm water pond construction areas. Figures 4.2 and 4.3 illustrate that the maximum concentration attributable to a unit emission rate from each source occurs at the source for all wind directions, due to the relatively low emission release heights. The concentrations exhibit a logarithmic decrease with distance from the source. The contributions due to each source at the north and south borders are shown in Figure 4.2. Contributions are also shown in Figure 4.3 for receptors on the east and west boundaries of the site.

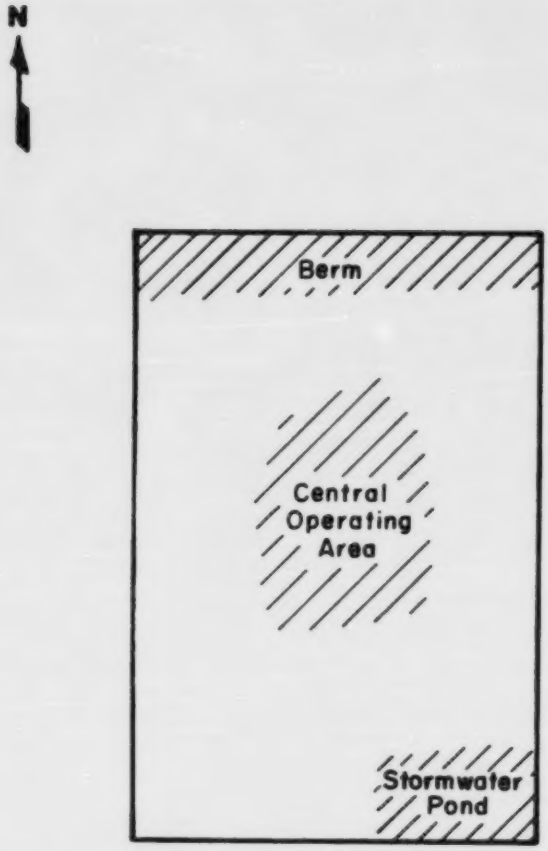


FIG. 4.1 . LOCATION OF CONSTRUCTION SOURCES OF FUGITIVE DUST AT THE OWMC SITE.

FIG. 4.2 SHORT TERM (1-HOUR) CONCENTRATIONS DUE TO FUGITIVE EMISSION SOURCES - CONSTRUCTION.

NORTH OR SOUTH WIND

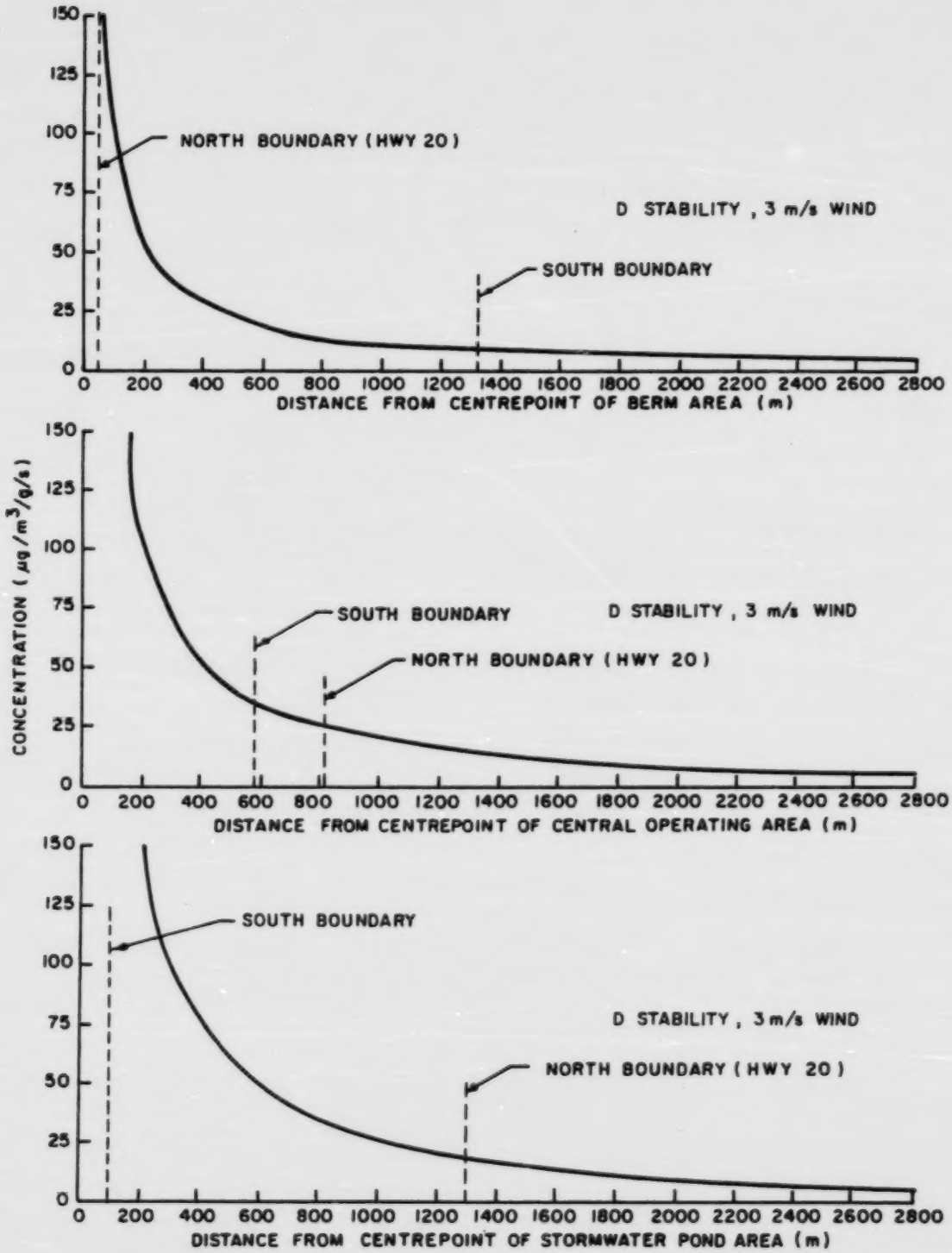
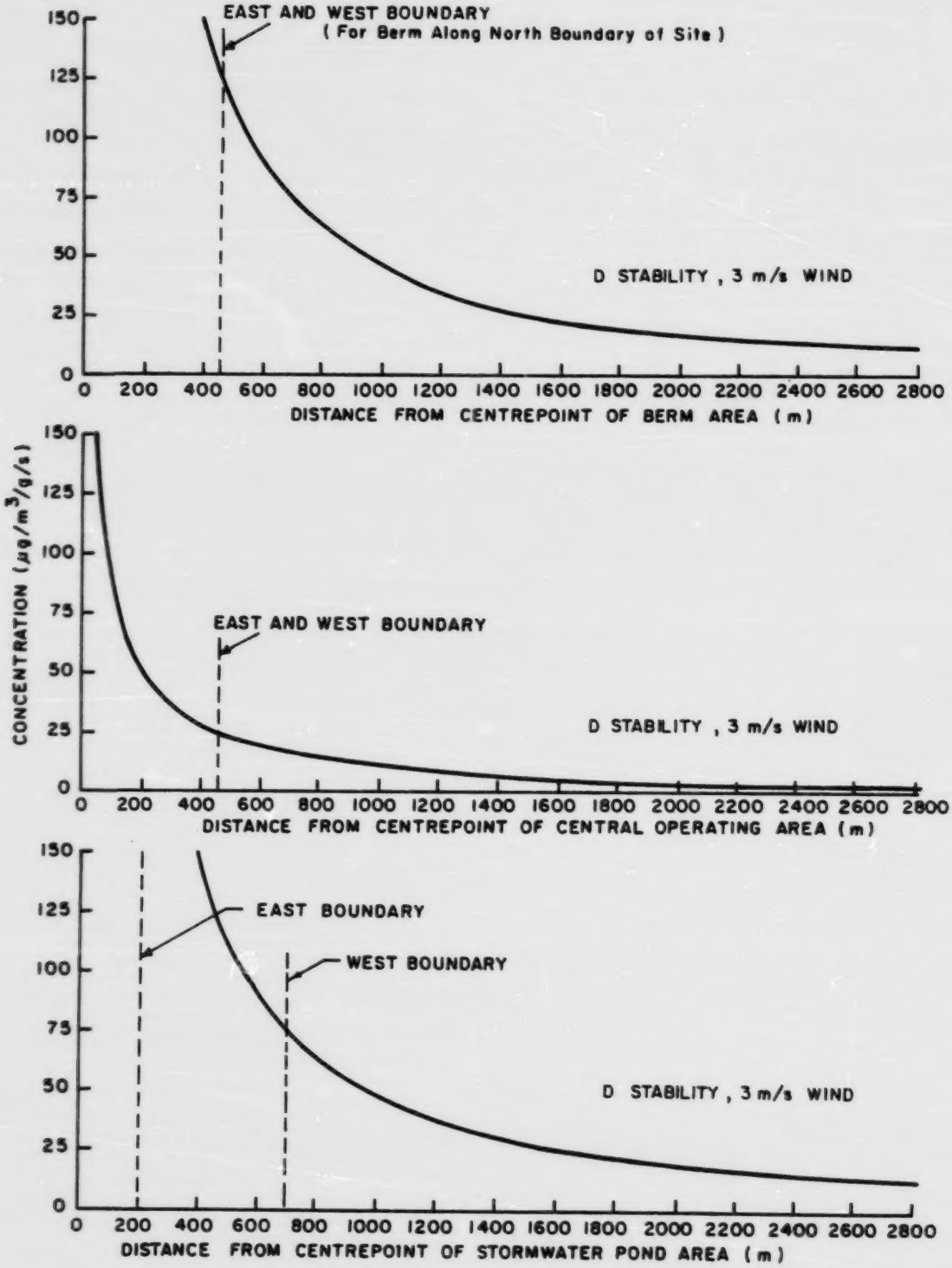


FIG. 4.3 SHORT TERM (1-HOUR) CONCENTRATIONS DUE TO FUGITIVE EMISSION SOURCES - CONSTRUCTION.
EAST OR WEST WIND



The long-term (annual and summer) construction dust modelling was undertaken using the Industrial Source Complex (ISC) Model (Bowers et al, 1979). A description of this model is contained in Appendix K. In summary, the ISC model treats the dispersion of area sources as finite line sources in which the concentrations of contaminants in a plume follow a normal distribution, or "bell" curve. In the long-term mode, ISC calculates concentrations at a given receptor for a complete range of meteorological parameters, and the results are weighted according to the frequency of occurrence of these parameters over the averaging period of interest (a year or a season).

Using the 10-year synthesized wind summaries and stability frequencies for the site, annual and summer estimates of concentrations were made, based on unit emission rates from the berm (along the north boundary), central operating area, and storm water pond, separately. These are presented in Figures 4.4 to 4.9, inclusive. The maximum concentration is predicted to occur at the east site boundary for the central operating area (both summer and annual), at the north boundary for the berm, and at the south (annual) and east boundary (summer) for the stormwater pond.

4.3.2 INCREMENTAL EFFECTS

Figure 4.10 illustrates the "worst-case" hourly concentrations downwind of the site's north boundary when predicted emission rates for the on-site sources from Section 4.2.2 are applied. This figure shows that estimated concentrations in excess of 900 $\mu g/m^3$ of total suspended particulate are attributed to construction of the berm at the north site boundary. The contribution from the central operating and stormwater pond area, however, are considerably less at the boundary (<150 $\mu g/m^3$ and <50 $\mu g/m^3$, respectively) and continue to decrease steadily with downwind distance. The total incremental concentrations drop off very quickly with distance downwind, from levels approaching 500 $\mu g/m^3$ at approximately 100 m from the north boundary, decreasing to approximately 100 $\mu g/m^3$ at a distance of 1 000 m from the boundary.

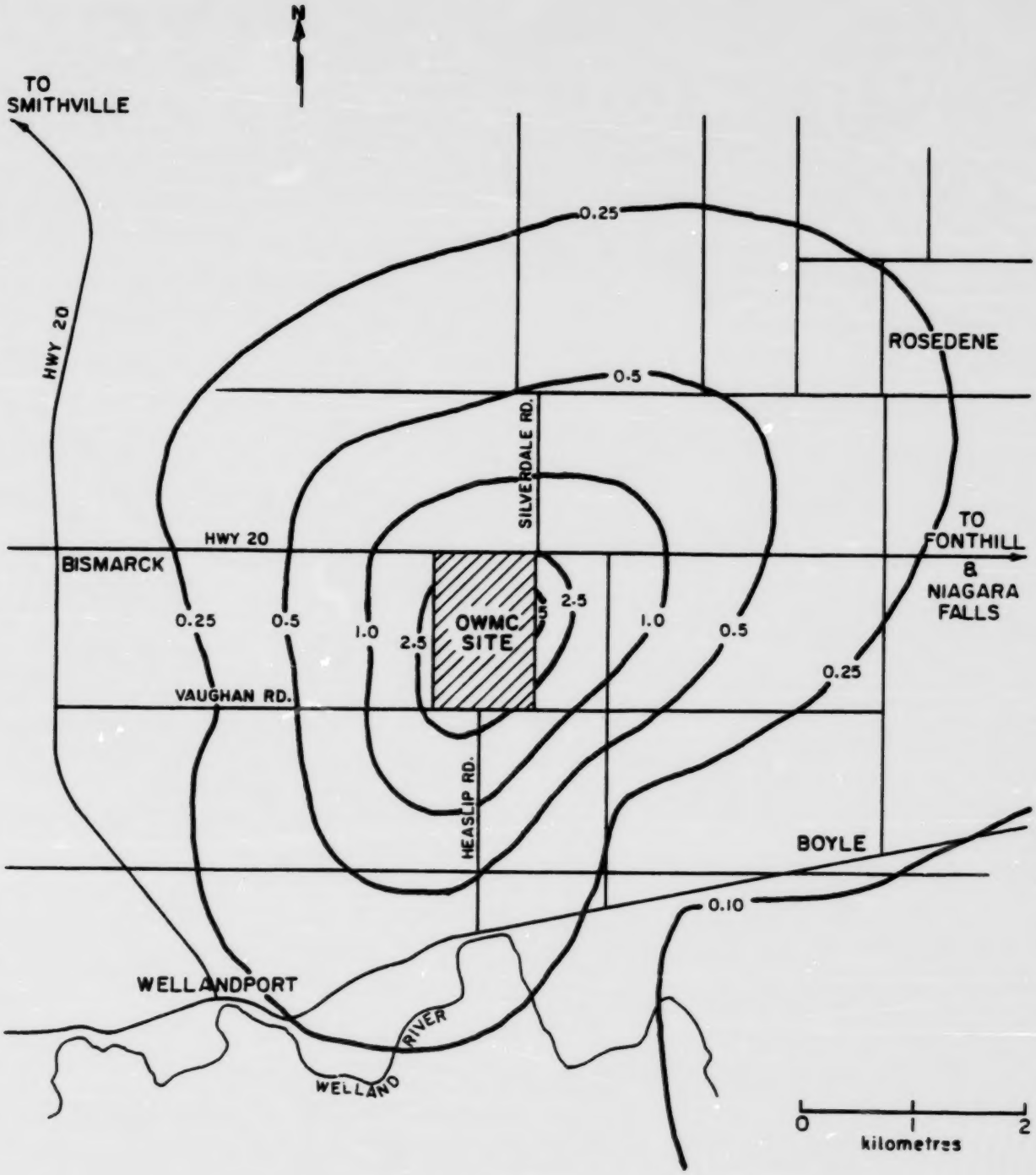


FIG. 4.4 ANNUAL AVERAGE GROUND LEVEL CONCENTRATIONS ($\mu g/m^3/g/s$)
FUGITIVE CONSTRUCTION DUST - CENTRAL OPERATING AREA ONLY

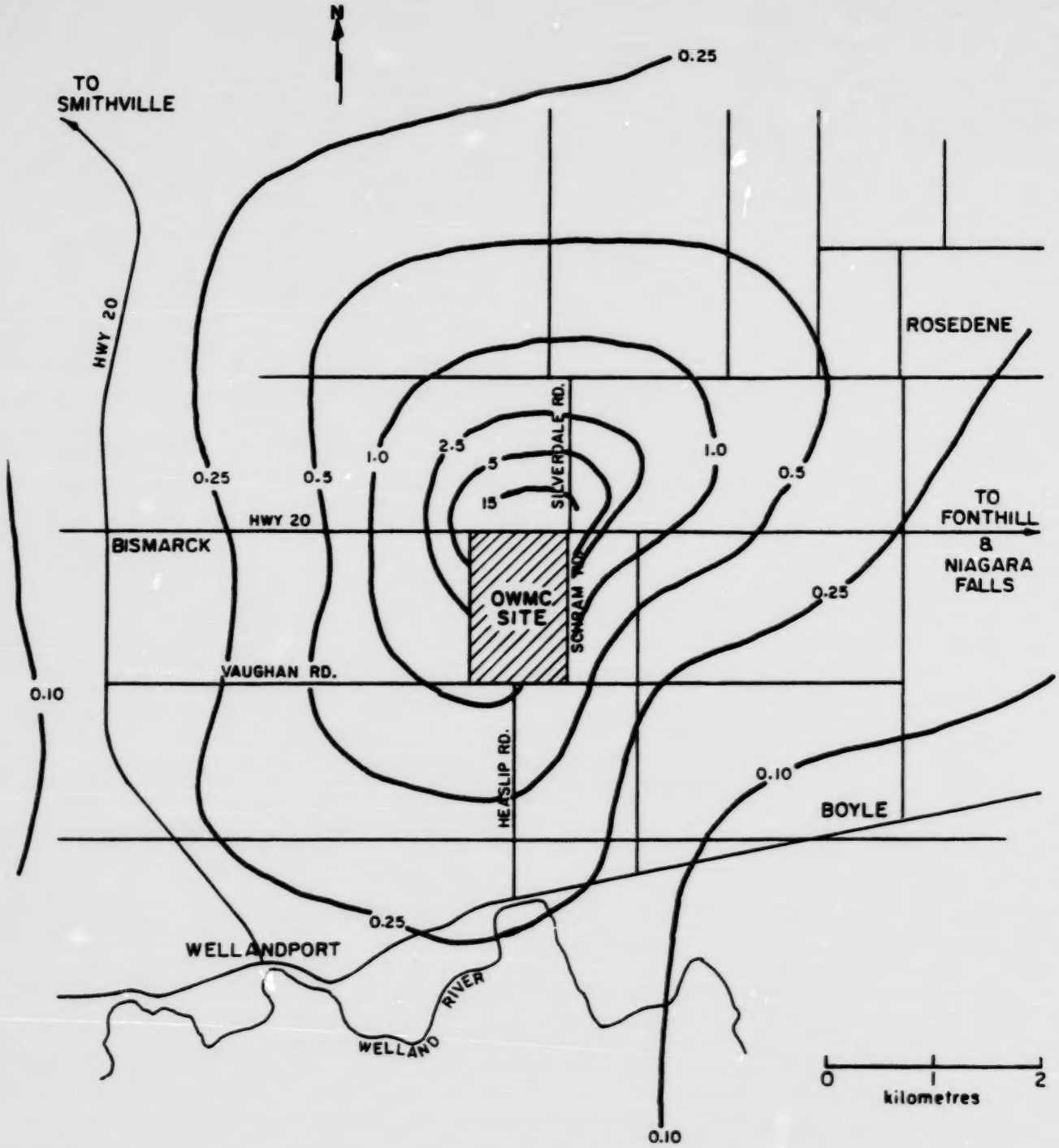


FIG. 4.5 ANNUAL AVERAGE GROUND LEVEL CONCENTRATIONS ($\mu g/m^3/g/s$)
FUGITIVE CONSTRUCTION DUST - BERM ONLY

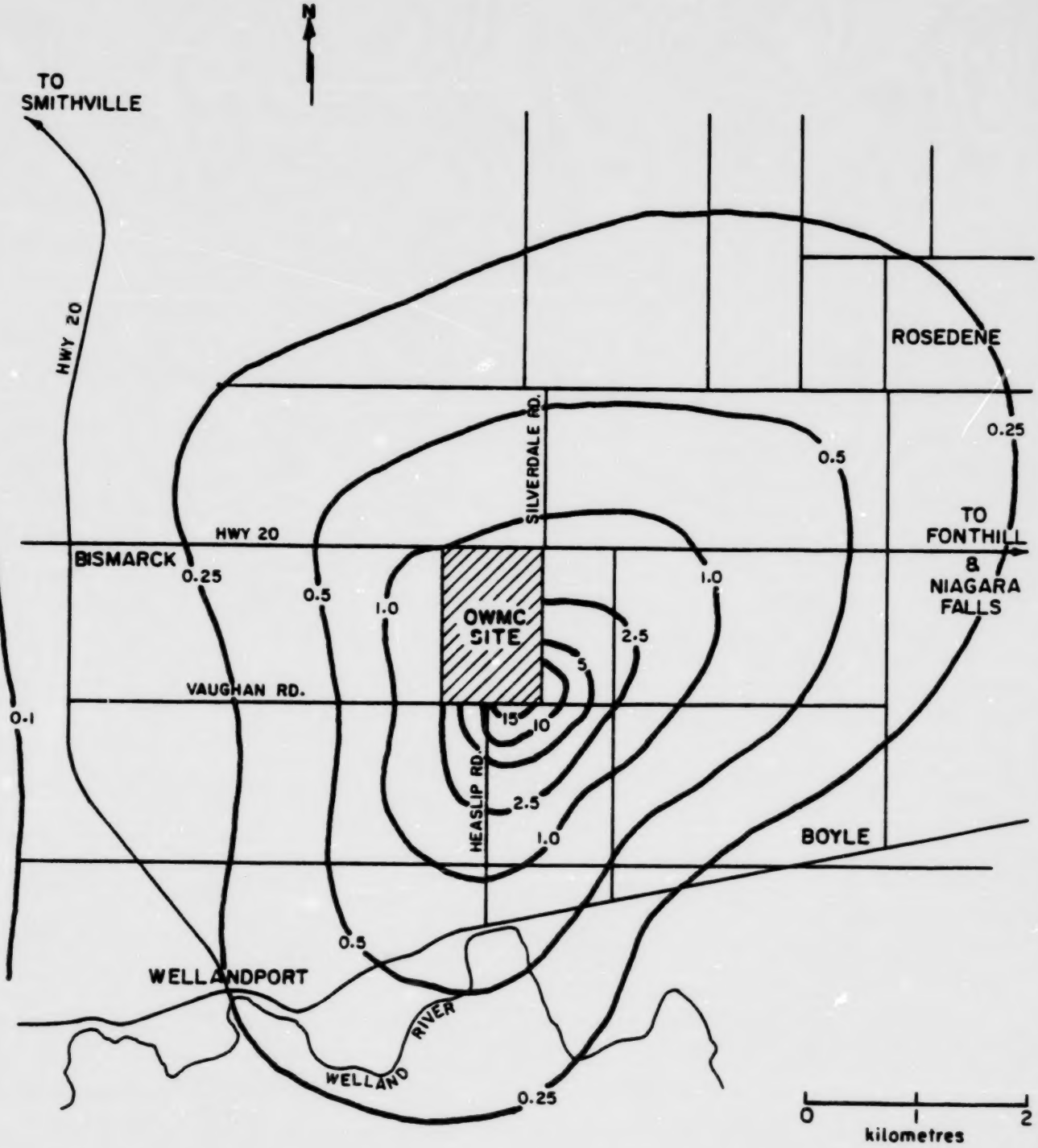


FIG. 4.6 ANNUAL AVERAGE GROUND LEVEL CONCENTRATIONS ($\mu g/m^3/g/s$)
FUGITIVE CONSTRUCTION DUST - STORMWATER PONDS ONLY

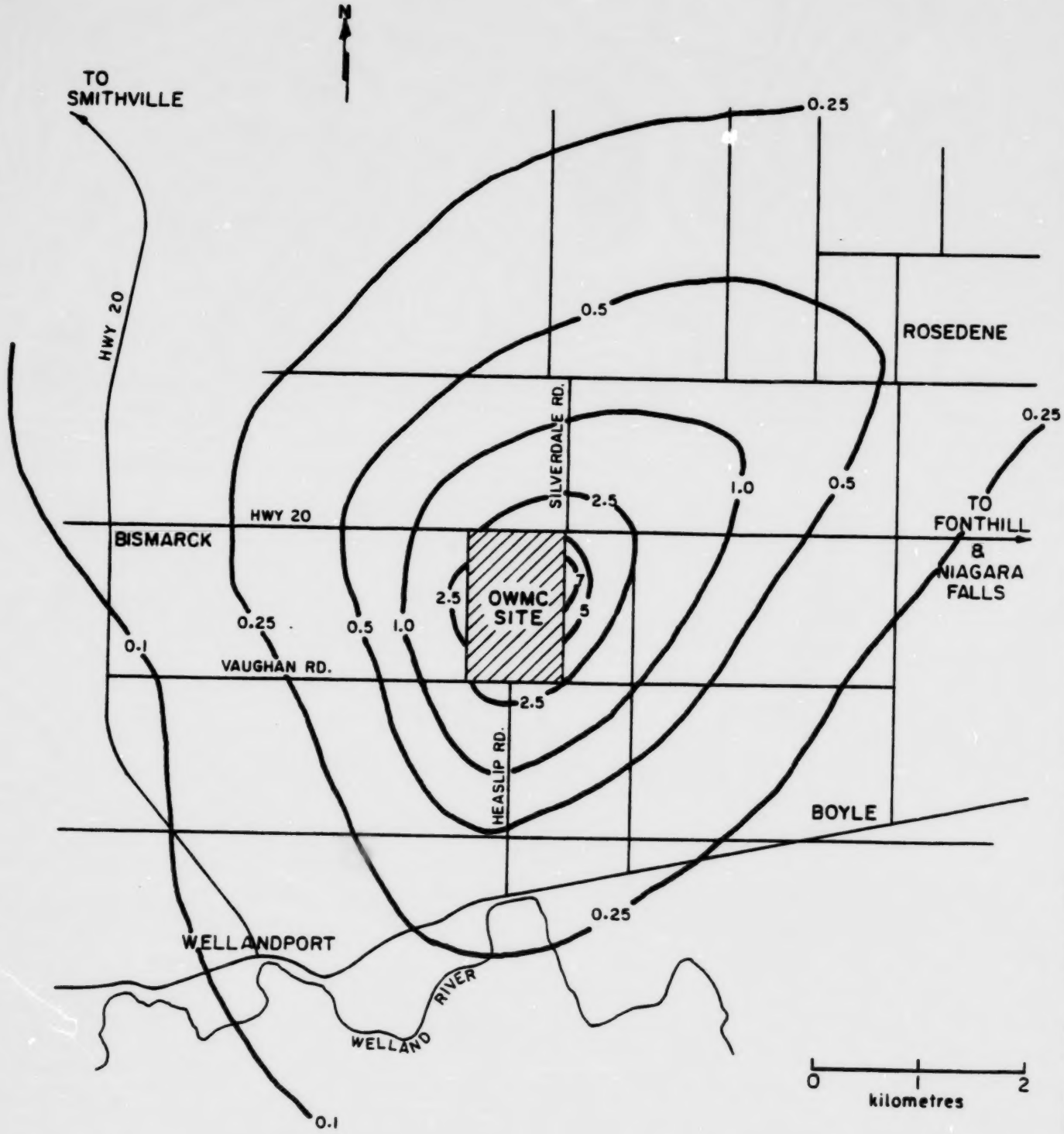


FIG. 4.7 SUMMER AVERAGE GROUND LEVEL CONCENTRATIONS ($\mu g/m^3/g/s$)
FUGITIVE CONSTRUCTION DUST - CENTRAL OPERATING AREA ONLY

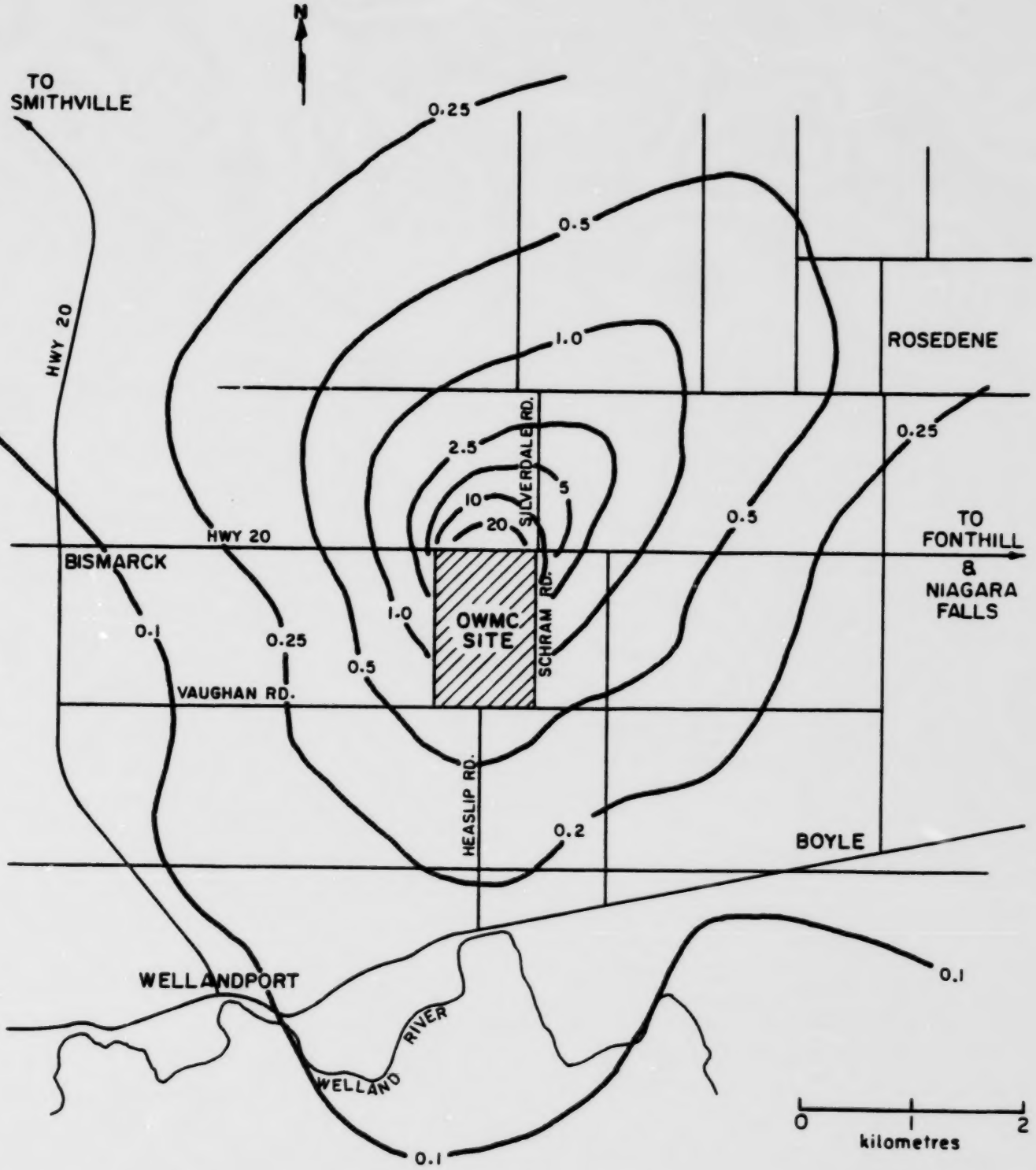


FIG. 4.8 SUMMER AVERAGE GROUND LEVEL CONCENTRATIONS ($\mu g/m^3/g/s$)
FUGITIVE CONSTRUCTION DUST - BERM ONLY

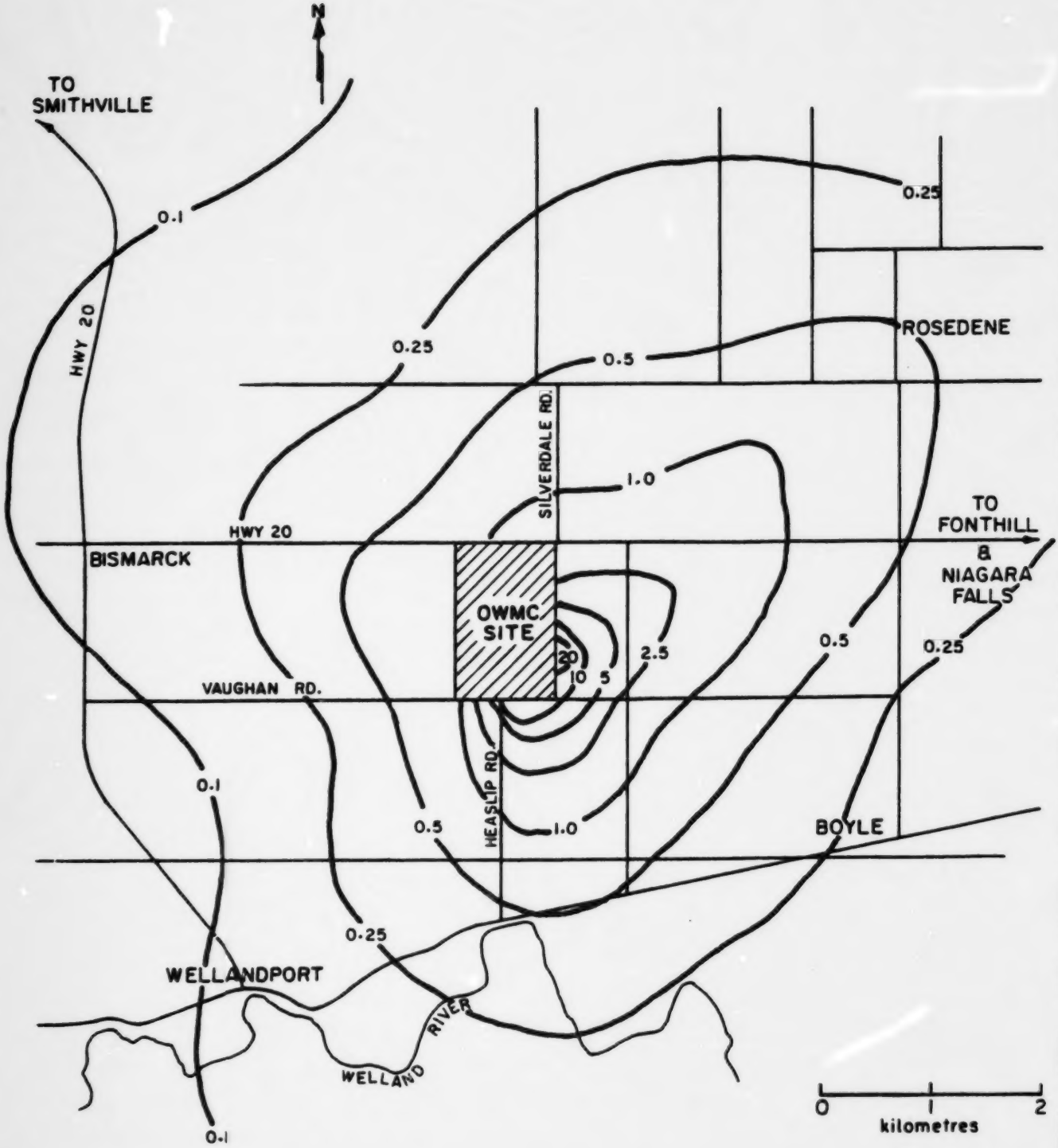


FIG. 4.9 SUMMER AVERAGE GROUND LEVEL CONCENTRATIONS ($\mu g/m^3/g/s$)
FUGITIVE CONSTRUCTION DUST - STORMWATER POND ONLY

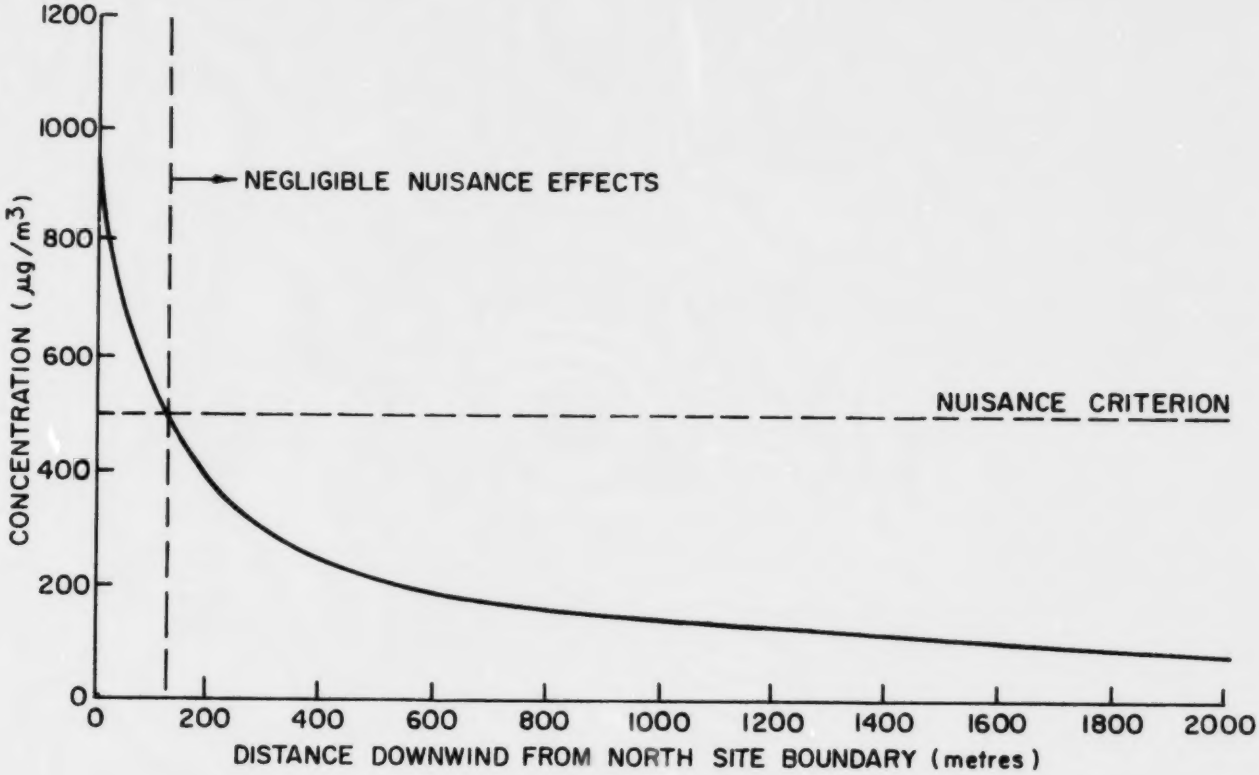


FIG. 4.10 SHORT-TERM (1-HOUR) SUSPENDED DUST CONCENTRATIONS DUE TO CONSTRUCTION ACTIVITIES .

Figures 4.11 and 4.12 illustrate concentration patterns due to on-site fugitive dust sources for both the annual and summer periods. Emission rates from Section 4.2.2 were used, along with other input parameters (summarized in Appendix J) to obtain concentration estimates representing the berm, the central operating area and the stormwater pond area sources combined. Maximum particulate concentrations attributable to construction, as predicted by the long-term model, are approximately 25 and 45 $\mu g/m^3$ for the annual and summer periods, respectively, and occur at the site border. Highest concentrations in the annual case occur to the north and northeast of the site. The summer plots show similar trends, with the highest concentrations also recorded to the northeast of the site, as well as to the north. Long-term concentrations are predicted to be less than 10 $\mu g/m^3$ beyond about 1000 m from the OWMC site boundary.

The predicted one-hour concentrations of re-entrained road dust, and CO, NO_x and HC from vehicle exhaust were calculated. These values were extrapolated to 8-hour and 24-hour averages (where applicable) for the purposes of comparison to the Ontario air quality criteria (see Table 2.1). The resulting concentrations are presented in Tables 4.1 and 4.2, for average and worst-case conditions, respectively. Particulate levels are expected to increase 18 percent due to OWMC construction, under average conditions, and 89 percent under worst-case conditions. CO emissions from vehicle exhaust are expected to increase 19 percent and 100 percent under average and worst-case conditions, respectively. NO_x exhaust emissions are predicted to increase 13 percent and 37 percent, for the average and worst case situations, respectively, and HC emissions are predicted to increase 16 percent and 71 percent for the average and worst-case scenarios. Maximum concentrations for all pollutants considered here are predicted to occur immediately adjacent to the road, decreasing to comparatively low levels after the first few hundred metres from the road.

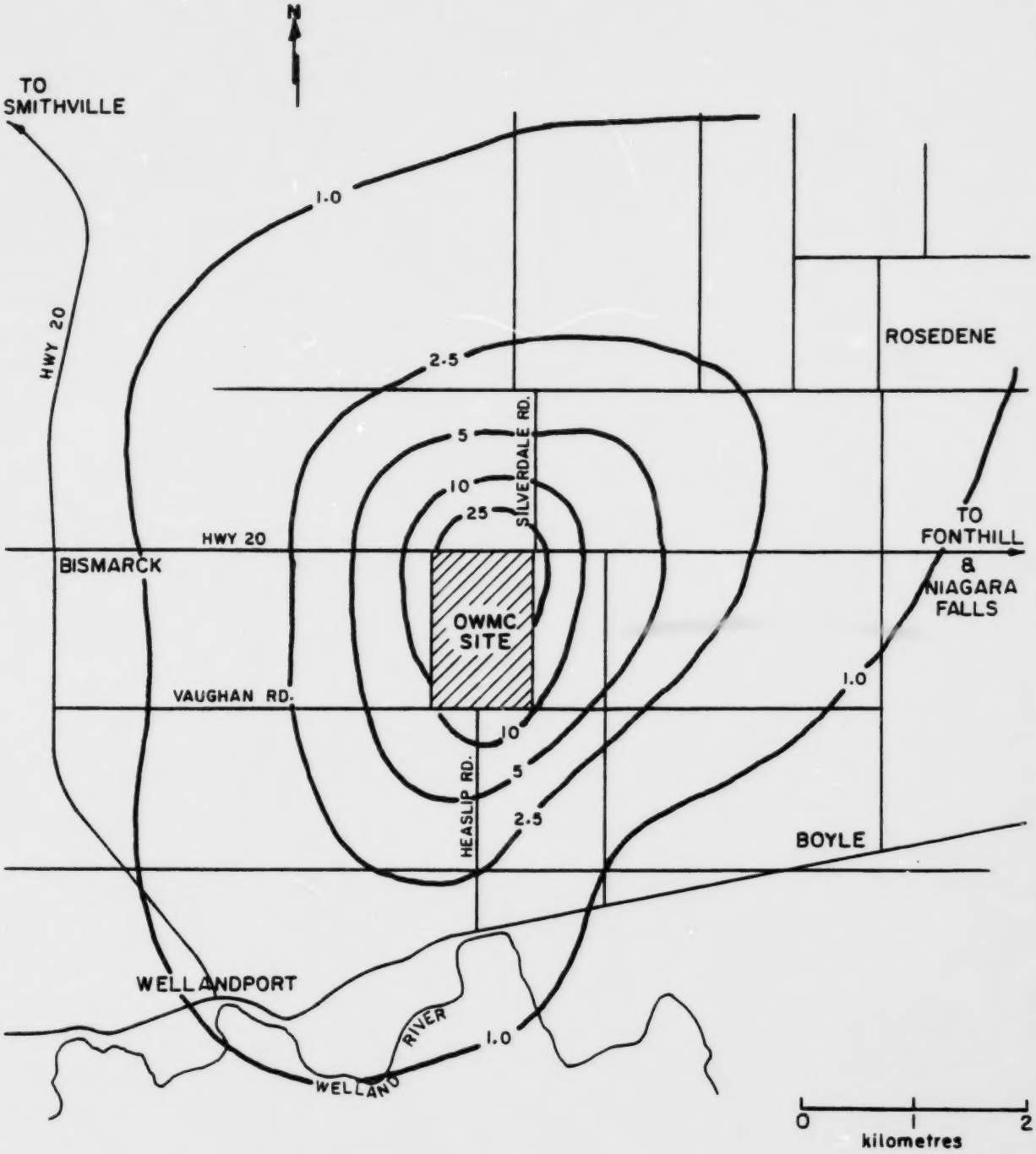


FIG. 4.11 ANNUAL AVERAGE GROUND LEVEL CONCENTRATIONS ($\mu g/m^3$) DUE TO SUSPENDED PARTICULATE MATTER FROM CONSTRUCTION ACTIVITIES

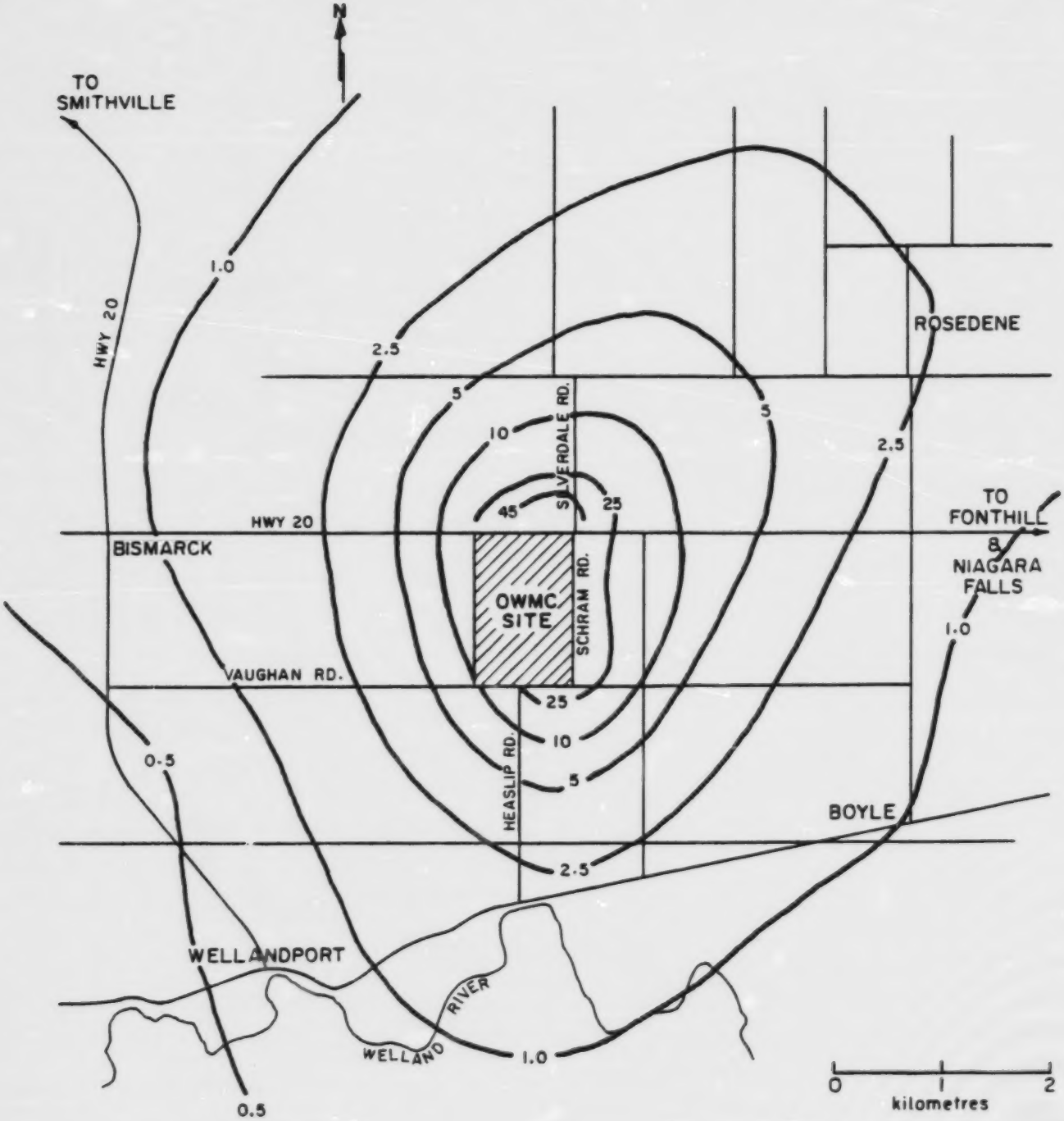


FIG. 4.12 SUMMER AVERAGE GROUND LEVEL CONCENTRATIONS ($\mu g/m^3$) DUE TO SUSPENDED PARTICULATE MATTER FROM CONSTRUCTION ACTIVITIES

TABLE 4.1

Effect of Vehicle Emissions on
Air Quality Along Access Roads - Average Conditions

Contaminant	Distance from Highway 20 (m)	Time Period	Concentrations ($\mu g/m^3$) Expected Levels in in 1990 (Without Facility)	Predicted Levels With OWMC Facility	Percentage Increase
TSP (Re-entrained)	100	24-h	8	9	
	200		5	5	18
	500		2	3	
CO (Exhaust)	100	8-h	5.8	7	
	200		3.2	4	19
	500		1.5	2	
NO_x (Exhaust)	100	1-h	4	5	
	200		2	3	13
	500		1	1	
	100	24-h	1	2	
	200		0.8	1	13
	500		0.4	0.4	
HC (Exhaust)	100	24-h	0.5	0.6	
	200		0.3	0.3	16
	500		0.1	0.2	

TABLE 4.2

Effect of Vehicle Emissions on
Air Quality Along Access Roads - Worst-Case Conditions

Contaminant	Distance from Highway 20 (m)	Time Period	Concentrations ($\mu g/m^3$) Expected Levels in in 1990 (Without Facility)	Predicted Levels With OWMC Facility	Percentage Increase
TSP (Re-entrained)	100	24-h	98	186	
	200		60	114	89
	500		30	55	
CO (Exhaust)	100	8-h	68	136	
	200		42	83	100
	500		20	41	
NO_x (Exhaust)	100	1-h	61	84	
	200		38	51	37
	500		18	25	
	100	24-h	22	30	
	200		14	19	37
	500		7	9	
HC (Exhaust)	100	24-h	7	12	
	200		4	7	71
	500		2	3	

4.3.3 ASSESSMENT CONSIDERING BACKGROUND AIR QUALITY

Total suspended particulate is measured routinely by the Ministry of the Environment at several rural locations in the Niagara Peninsula, with annual geometric means in recent years ranging from 26 to 59 $\mu g/m^3$ (see Appendix H). Mean dust levels measured at the OWMC site during the baseline studies indicate an annual geometric mean of approximately 29 $\mu g/m^3$ (see Chapter 3). This value can be considered to be representative of existing or background levels on-site. The maximum long-term increments due to construction, as predicted by dispersion modelling, were approximately 25 $\mu g/m^3$ for the annual case, and approximately 45 $\mu g/m^3$ for the summer case. This indicates that annual average particulate levels can be expected to approximately double near the north site boundary during the construction period. However, the increment at distances of 1 km or more from the site is less than 10 $\mu g/m^3$ (i.e., approximately a third of existing levels).

Background levels measured on-site for 24-hour periods have varied from 6 to 123 $\mu g/m^3$. However, historically, maximum 24-hour values in excess of 300 $\mu g/m^3$ have been recorded at rural station locations in the Niagara Peninsula (Appendix H). The 24-hour increment attributable to construction was not modelled directly, but has been extrapolated from the worst-case hourly concentration and the maximum annual concentration, resulting in an estimated maximum 24-hour concentration increment of 280 $\mu g/m^3$. However, past the first five hundred metres from the site boundaries, the increment would be much less significant, with an estimated maximum of 72 $\mu g/m^3$ over a 24-hour period.

Background levels of TSP, CO, NO_x and HC measured on-site or obtained from the literature do not apply to locations adjacent to roadways. The effects of vehicle emissions are localized due, in part, to the low height of emission. Therefore, existing levels of the pollutants due to these mobile sources were modelled, as summarized in Tables 4.1 and 4.2.

4.3.4 ASSESSMENT CONSIDERING AIR QUALITY STANDARDS AND CRITERIA

The Ontario annual ambient air criterion for total suspended particulate is 60 $\mu g/m^3$ (see Table 2.1). A comparison of the annual mean background level on-site (29 $\mu g/m^3$) with the maximum levels estimated by the long-term model at the site boundary (25 $\mu g/m^3$) would indicate that, including background levels, concentrations should be well within this criterion at all off-site locations during construction.

The short-term 1/2-hour point-of-impingement standard for total suspended particulate is 100 $\mu g/m^3$. However, this level is commonly exceeded under natural background conditions, even in rural areas. As well, it is below the levels at which a perceptible nuisance (soiling of surfaces) would be evident. To assess dust nuisance effects, the downwind concentrations are more appropriately compared with a dust nuisance criterion. Dustfall can become a perceptible nuisance when it exceeds 8000 $\mu g/m^2$ (based on the MOE's 1/2-hour standard, see Appendix A), which is equivalent to about 500 $\mu g/m^3$ suspended particulate, (assuming a 1 cm/s particulate deposition velocity). This value of approximately 500 $\mu g/m^3$ was used to represent the level at which the construction dust may become a perceptible nuisance to local residents, on a short-term basis. Studies on the public awareness of particulate pollution suggest that awareness of nuisance effects begins at levels of approximately 60 $\mu g/m^3$ on a seasonal basis (USDHEW, 1969). Equivalent short-term concentrations are of the order of ten times this figure. This further supports the use of a short-term criterion of 500 $\mu g/m^3$ for predicting dust nuisance effects.

Figure 4.10 illustrates that a concentration of 500 $\mu g/m^3$ attributable to construction dust from the central operating area, berm and storm water pond areas combined is predicted at a downwind distance of just greater than 100 m.

Ambient air levels of TSP, NO_x and CO, predicted to result from vehicle emissions (Tables 4.1 and 4.2), were compared to the Ontario

air quality criteria (listed in Table 2.1). There are no criteria for hydrocarbons. Maximum TSP levels under average conditions are well below 120 $\mu g/m^3$, which is the 24-hour criterion, but are slightly above the criterion in the worst-case scenarios, at a distance of 100 m from the road. As shown in the tables, levels decrease with downwind distance and are all less than 120 $\mu g/m^3$ at distances of 200 m or more from the road. The 8-hour criterion for CO (15 700 $\mu g/m^3$) is not expected to be exceeded in either the average or worst-case situation. Predicted NO_x levels were compared to the 1-hour criterion for NO_2 (400 $\mu g/m^3$) and the 24-hour criterion for NO_2 (200 $\mu g/m^3$), and found to be well below these levels.

4.4 MITIGATION OF EFFECTS

The quantity of dust emissions from construction operations are proportional to the area of land being worked and the level of activity at any given time. These could be controlled, if required, by appropriate phasing of construction activities. As well, watering is often selected as a control method because water and the necessary equipment are usually available at construction sites. The effectiveness of watering on unpaved roads and inactive areas of the construction site depends on the frequency of application. Twice daily coverage is estimated to reduce dust emission by up to 50 percent. More frequent applications could result in close to 100 percent effectiveness. Covering or re-vegetation of inactive areas to reduce wind erosion can also substantially reduce emissions (USEPA, 1985).

In the above estimates of dust emissions, it has been assumed that the minimization of such emissions will be part of the normal construction practices. In order to achieve the projected emission rates it is expected that the following measures will be required to control dust emissions, particularly in dry weather:

- wetting of roads,
- control of vehicle speeds on site,
- minimizing wind erosion by covering areas not in use by re-vegetation, compacting surfaces, or application of water, and
- removal of excess soil tracked onto access roads by vehicles leaving the site.

Unfortunately, it is very difficult to accurately predict fugitive dust emissions associated with construction and the effectiveness of any given control program. Thus, the above assessment of impacts may be subject to some uncertainty, although efforts have been made to represent reasonable worst-case conditions. At the same time, such fugitive emissions have the potential to be a nuisance to the neighbours of the construction site. It is, therefore, recommended that the monitoring and assessment of dust and odour emissions and their impacts be part of an ongoing review of OWMC's construction activities. Depending on the results of this review, the dust control measures listed above could be relaxed or intensified and, if required, other measures implemented. Among the additional measures which could be considered are:

- further limitation of exposed areas and earth stockpiles,
- further reduction of vehicle speeds on site, and other traffic controls, e.g., a limit on the number of vehicles permitted on site, and
- phasing of construction activities to reduce the number of simultaneous dust sources.

It is not anticipated that off-site vehicle exhaust emissions or re-entrained dust emissions from paved roads will require mitigation.

4.5 MONITORING

Construction monitoring will consist primarily of monitoring ambient dust levels during active construction periods. Details of this program have yet to be determined. However, it is suggested that total suspended particulate (TSP) and fine particulate (FP) monitoring should be measured at the existing monitoring station (300 m north of the SE corner of the site) plus one other location, probably at the NE edge of the site. This could be supplemented by TSP sampling at two other locations around the site boundary, plus a number of dustfall monitors. The 24-hour TSP and FP samplers may be collected every third day, as in the baseline program (1986-87). However, consideration should be given to collecting daily samples during periods of greatest potential dust generation (e.g., site clearing and major excavations). Dustfall should be measured as 30-day accumulations.

Pre-operational monitoring is suggested for the one year period prior to scheduled start-up of the facility, and it is anticipated that this will coincide with much of the construction activities. Two monitoring stations (in addition to the existing baseline station) are suggested to measure SO_2, NO_x, CO, HC, and TSP (every 3rd day), the major potential pollutants (with the exception of TSP) expected to be emitted in construction vehicle exhaust.

Details of the suggested monitoring program, which includes the construction phase, are given in Appendix L. Ministry (MOE) agency and public input is expected before this monitoring program is implemented.

4.6 CONCLUSION

Construction activities at the OWMC site are expected to produce fugitive dust emissions from time to time, due to the operation of excavation equipment and vehicle movements around the site. The potential for dust

suspension depends, to a large extent, on the day-to-day and hour-to-hour level of activity, the specific operations carried out, and the prevailing weather conditions. However, the implementation of good construction practices, including dust suppression methods such as water spraying, particularly during extended dry spells, should keep dust emissions to a minimum. Experience elsewhere suggests that, under such circumstances, any impacts due to dust emissions would be infrequent, of short duration, and limited to the site and its immediate vicinity.

The quantitative prediction of dust impacts is inherently difficult in this case, due to the large number of assumptions necessary and uncertainties in the calculation of emission rates, including the precise effect of dust suppression methods. However, analyses conducted to date, based on the most adverse conditions for dust generation and subsequent dispersion, confirm the above observation that any nuisance effects (e.g., soiling of surfaces) which might occur would be limited to properties immediately adjacent to the preferred site. The numerical evaluation was carried out for the construction of a 150 000 t/a facility. If the facility is subsequently expanded to handle 300 000 t/a, the impacts due to construction as a result of the expansion are expected to be minimal, since they would be confined to certain parts of the central operating area and will not involve major earth excavations.

Monitoring of construction activities should be carried out to ensure that off-site dust levels are kept within acceptable limits. In addition to the normal practices to ensure dust suppression, other mitigation measures could be implemented as required in response to specific adverse situations.

5. EFFECTS OF OPERATION

5.1 INTRODUCTION

The Ontario Waste Management Corporation (OWMC) has proposed to handle and treat industrial waste that cannot be adequately dealt with by existing and/or conventional treatment facilities. Organic wastes are to be destroyed thermally in a rotary kiln incinerator. The inorganic wastes are to be rendered stable and non-toxic by physical/chemical treatment processes. Treatment residues would be solidified and disposed of in an engineered landfill, along with the slag and solidified residues from the incinerator. Potential routine emissions to the atmosphere from these facilities are considered in this chapter. The potential emissions are then evaluated by determining the resultant ambient air concentrations and comparing them to Ontario standards, guidelines and criteria, and the existing air quality at OWMC's preferred site in the Township of West Lincoln.

The following analysis addresses in detail the effects on air quality of the normal operation of a 150 000 t/a facility, including a single rotary kiln incinerator of 30 000 t/a capacity. The effects of doubling the facility capacity (to 300 000 t/a, including two 30 000 t/a incinerators) are addressed with reference to the results for the 150 000

t/a design (see section 5.4). Process upsets and accidental emissions are not included. These are addressed as part of a separate hazard analysis of the facility (Battelle, 1987).

5.2 EMISSIONS DURING NORMAL OPERATIONS

5.2.1 OFF-SITE VEHICLE EMISSIONS

Re-entrained dust and exhaust emissions due to vehicular traffic on off-site roads can be expected to increase somewhat once the facility is operational, compared to projections for the same roads without the OWMC facility.

The predicted numbers of vehicles which will be travelling along Highway 20 in the year 1995 (without the facility) are 578 trucks/day and 3032 cars/day (both directions). The expected daily traffic into and out of the OWMC facility will consist of 40 waste trucks, 5 additive and reagent trucks and 14 clay and granular material trucks (118 2-way truck trips and 364 2-way car trips) (see Appendix J).

Factors which influence re-entrained dust emissions are the volume of traffic, average vehicle weights, and the surface dust loading on the road. Predominant sources of these emissions are expected to be the trucks delivering waste and granular material for the landfill, dump trucks hauling excavated clay off-site and the employees' vehicles.

Dust emission factors for the off-site paved roads were used to calculate emission rates associated with the above traffic. These emission rates are provided in Appendix O, together with the emission rates of carbon monoxide (CO), hydrocarbons (HC) and nitrogen oxides (NO_x) due to vehicle exhaust.

It should be noted that the off-site vehicular movements presented above are subject to change as the landfill operating plan is refined. Any such changes would result in corresponding changes in the air emissions assumed in this assessment.

5.2.2 INCINERATOR STACK EMISSIONS

Organic wastes will be thermally destroyed in a rotary kiln incinerator. Theoretically, during complete combustion, the organic waste is reacted with oxygen at high temperatures and forms carbon dioxide and water vapour, plus some combustion products, such as nitrogen oxides and hydrogen chloride. Certain inorganic substances which may be present in the waste (e.g., metals), may also be present in the combustion gases. Complete combustion depends not only on the characteristics and quantity of the waste feed, but also on operating conditions.

Emissions and test data supplied by OWMC's incinerator supplier (Von Roll) and test data from similar industrial waste treatment plants were used to estimate the emissions from the OWMC incinerator. The air emissions from the incinerator were organized into four classes of related contaminants: acid gases, metals, organics and other pollutants.

The acid gases addressed in this study are hydrogen chloride (HCl), hydrogen fluoride (HF), nitrogen oxides (NO_x) and sulphur dioxide (SO_2). Polyvinyl chloride materials in solid wastes and various chlorinated hydrocarbons in liquid organic wastes result in emissions of HCl. Emissions of HF are also a result of fluorinated liquid organic wastes. Emissions of HCl and HF are dependent on the waste type, the chlorine and fluorine contents in the wastes, the incinerator type and the flue-gas treatment system. Sulphur dioxide originates from sulphur in the waste feed or sulphur in the incinerator auxiliary fuel. Nitrogen oxides arise from high temperature combustion of air which contains nitrogen.

The presence of metals in the organic waste results in metals emissions to the atmosphere. Many metals evaporate in the combustion flame or form volatile metal oxides, chlorides or other salts. When passing through the cooler parts of the incinerator exhaust system, such as the scrubbing systems, the vapourized metals condense to form aerosols. Most of the heavy metals in the waste remain in the kiln and

boiler ash. The portion which remains airborne is largely removed by the flue-gas treatment system, with a very small portion passing through the control system and being emitted to the atmosphere.

The following criteria were used in estimating emission rates for the reference design (incinerator capacity of 30 000 t/a):

- except as noted below, emission rates were based on the supplier's guaranteed and expected exhaust concentrations with the maximum design exhaust flowrate (25 400 Normal m^3/h per unit, dry, at 7 percent oxygen or 50 percent excess air) and the average exhaust flowrate (22 860 Nm^3/h), respectively,

- in the absence of emission data from the supplier, the largest and average exhaust concentrations found in the literature were used, and

- emissions of unburned or residual organics were based on a DRE of 99.99 percent (99.9999 percent for PCBs) and either the average or maximum feed rate for each compound identified.

Potential incinerator emission rates based on the above are given in Table 5.1. The literature on emissions at other rotary kiln facilities is reviewed in Appendix M. This appendix also contains the basic design data for the OWMC incinerator and the supplier's expected and guaranteed emission concentrations.

5.2.3 PHYSICAL/CHEMICAL TREATMENT PLANT EMISSIONS

A potential point source of emissions to the atmosphere from the physical/chemical treatment plant is the stack associated with the effluent evaporator. Some other parts of the plant were considered to be potential fugitive emission sources (see Section 5.2.5). Appendix N describes the methodology used in estimating evaporator emissions.

TABLE 5.1: Incinerator Stack - Emission Rates

	AVERAGE EMISSIONS		SHORT-TERM PEAK EMISSIONS		
	Average Mass Fraction	Emission Rate(a) (g/s)	Maximum Mass Fraction	Maximum Feed Rate (kg/h)	Emission Rate(b) (g/s)
RESIDUAL ORGANICS:					
Acetates	0.01480000	0.0002022667	0.9000	4760	0.11900
Acetone	0.00558000	0.0000762600	0.9900	2147	0.05904
Acrylonitrile	0.00010700	0.0000014623	0.1000	2009	0.00558
Alcohols	0.00057700	0.0000078857	0.2500	2247	0.01560
Aldehydes	0.00000037	0.0000000051	0.0200	4760	0.00264
Amines	0.00001250	0.0000001708	0.0006	4760	0.00008
Anhydrides	0.00150000	0.0000205000	0.3000	4760	0.03967
Benzene	0.00060900	0.0000083230	0.2000	1588	0.00882
Benzothiazoles	0.00001620	0.0000002214	0.0300	4760	0.00397
Benzo(a)anthracene	0.00000806 *	0.0000001102	0.0007	4760	0.00009
Benzo(a)pyrene	0.00000323 *	0.0000000441	0.0004	4760	0.00005
Butadiene	0.00000949	0.0000001297	0.0005	4760	0.00007
Carbon tetrachloride	0.00031000	0.0000042367	0.6000	4760	0.07933
Chlorinated benzenes	0.00001040	0.0000001421	0.0030	2414	0.00020
Chlorinated ethylenes	0.00602000	0.0000822733	0.9900	4760	0.13090
Chloroform	0.00052000	0.0000071067	0.5000	3679	0.05110
Cresols	0.00045200	0.0000061773	0.3300	1947	0.01785
Ethylene glycol	0.01870000	0.0002555667	0.9500	3509	0.09260
Ethylene oxide	0.00000813	0.0000001111	0.0005	4760	0.00007
Formaldehyde	0.00028800	0.0000039360	0.0200	3564	0.00198
Freons	0.00206000	0.0000281533	0.9900	4760	0.13090
Glycerine	0.00011700	0.0000015990	0.2000	3696	0.02053
Hexane	0.00337000	0.0000460567	0.5000	1379	0.01915
Hydrazine	0.00000003	0.0000000004	0.0500	3588	0.00498
Isopropyl alcohol	0.00082300	0.0000112477	0.9800	2016	0.05488
Ketones	0.00558000	0.0000762600	0.7500	4760	0.09917
Methyl ethyl ketone	0.00558000	0.0000762600	0.9000	1972	0.04930
Methyl isobutyl ketone	0.00558000	0.0000762600	0.9500	4760	0.12561
Methylene chloride	0.00511000	0.0000698367	0.9600	4760	0.12693
Naphthalene	0.00016200	0.0000022140	0.5000	1655	0.02299
PCB	0.00115000	0.0000001572	0.9900	550	0.00015
Perchloroethylene	0.01440000	0.0001968000	0.9900	3848	0.10582
Petroleum distillate	0.02770000	0.0003785667	0.9900	4760	0.13090
Phenol	0.00238000	0.0000325267	0.9500	2048	0.05404
Pyridine	0.00031500	0.0000043050	0.1000	2034	0.00565
Styrene	0.00025400	0.0000034713	0.3500	1587	0.01543
Tetraethyl lead	0.00000213	0.0000000291	0.0100	3943	0.00110
Toluene	0.01220000	0.0001667333	0.9900	1571	0.04320
Trichloroethane	0.01360000	0.0001858667	0.9900	4760	0.13090
Trichloroethylene	0.00219000 *	0.0000299300	0.9900	4760	0.13090
Trichlorotrifluoroethane	0.01340000 *	0.0001831333	0.9900	4760	0.13090
Xylene	0.00953000	0.0001302433	0.9900	1553	0.04271

TABLE 5.1 (contd.): Incinerator Stack - Emission Rates

	AVERAGE EMISSIONS		SHORT-TERM PEAK EMISSIONS	
	Expected Stack Concentratn.(c) (mg/Nm3)	Emission Rate(d) (g/s)	Maximum Stack Concentratn.(e) (mg/Nm3)	Emission Rate(f) (g/s)
ACID GASES:				
Hydrogen chloride	15.0	0.09525	70.00000	0.4938889
Hydrogen fluoride	1.0	0.00635	4.00000	0.0282222
Nitrogen oxides	200.0	1.27000	1000.00000	7.0555556
Sulphur dioxide	150.0	0.95250	350.00000	2.4694444
METALS:				
Antimony	5.0	0.03175	14.00000	0.0987778
Arsenic	1.0	0.00635	2.80000	0.0197556
Beryllium	0.2	0.00127	0.00004 *	0.0000003
Cadmium	0.2	0.00127	0.60000	0.0042333
Chromium	1.0	0.00635	2.80000	0.0197556
Cobalt	1.0	0.00635	2.80000	0.0197556
Copper	5.0	0.03175	14.00000	0.0987778
Iron	0.9 *	0.00572	1.00000	0.0070556
Lead	5.0	0.03175	14.00000	0.0987778
Manganese	5.0	0.03175	14.00000	0.0987778
Mercury	0.2	0.00127	0.60000	0.0042333
Nickel	1.0	0.00635	2.80000	0.0197556
Selenium	1.0	0.00635	2.80000	0.0197556
Tellurium	1.0	0.00635	2.80000	0.0197556
Thallium	0.2	0.00127	0.60000	0.0042333
Vanadium	5.0	0.03175	14.00000	0.0987778
Zinc	5.0	0.03175	7.00000 *	0.0493889
PIC's (not included with residuals):				
Carbon disulphide	0.032 *	0.0002032	0.03200 *	0.0002258
Ethyl benzene	0.0008 *	0.00000508	0.00100 *	0.0000071
Methyl bromide	0.0001 *	0.000000635	0.00100 *	0.0000071
Methyl chloride	0.145 *	0.00092075	0.28000 *	0.0019756
PCDD	0.000004 *	0.0000000254	0.00004 *	0.0000003
PCDD + PCDF	0.000024 *	0.0000001524	0.00004 *	0.0000003
PCDF	0.00002 *	0.000000127	0.00010 *	0.0000007
Pentachlorophenol	0.006 *	0.0000381	0.00600 *	0.0000423
Vinyl chloride	0.007 *	0.00004445	0.01400 *	0.0000988
MISCELLANEOUS				
Carbon monoxide	70	0.44450	280	1.9755556
Cyanide	5	0.03175	14	0.0987778
Particulate	15	0.09525	70	0.4938889
Total hydrocarbons	15 (g)	0.09525	56 (g)	0.3951111

Notes:

(a) based on total feed rate of identified compounds of 3 446t/a (492kg/hr) with DRE of 99.99% (99.9999% for PCB)
(b) based on maximum feed rate for compound (max. design rate for incinerator is 4760kg/h) with DRE of 99.99% (99.9999% for PCB)
(c) based on supplier's expected flue gas concentrations (at 50% excess air and 7% O2)
or, if unavailable, median of literature values (*)
(d) for average flue gas flow rate of 22 860Nm3/hr
(e) based on supplier's guaranteed maximum flue gas concentrations (at 50% excess air and 7% O2)
or, if unavailable, largest of literature values (*)
(f) for design maximum flue gas flow rate of 25 400Nm3/hr
(g) as organic carbon
* possible constituent of "oil & grease" only, not identified in waste data base

Table 5.2 gives contaminant emission rates, based on the calculations described in Appendix N, assuming that all the organic compounds present in the effluent stream to the evaporator are available for discharge from the stack. For each contaminant, a maximum contaminant discharge rate is given for the 15 t/h case and for the very rare case in which the effective treatment rate is 36 t/h.

Further potential impacts associated with the evaporator stack may result from moisture present in the flue gases (e.g., plume visibility, fogging and icing at ground level). These are evaluated in a later section of this chapter.

5.2.4 FUGITIVE DUST EMISSIONS - LANDFILL AND OTHER SOURCES

The major fugitive dust emission source during operation of the OWMC facility is expected to be the landfill excavating and filling operations.

Fugitive dust can be generated at a landfill operation in a number of ways. Road dust can be re-entrained by vehicle traffic, with higher emissions expected from travel on unpaved areas or roads. Loading and unloading materials can also generate dust. Wind erosion of uncovered areas is another potential source. Factors which influence the amount of fugitive dust created by such operations or actions include the soil moisture content, the soil silt content, the areas exposed or uncovered, the time of year activities take place, prevailing meteorological conditions, the number and types of vehicles and machinery working on-site and the speed and travel distances of moving vehicles (USEPA, 1985).

Emission factors were derived as the bases for estimating the potential fugitive dust emission rates from OWMC landfilling operations over three time scales (i.e., short-term or one-hour, annual, and summer). Re-entrained road dust due to vehicles involved in landfill excavation operations, gravel deliveries and clay transport were

TABLE 5.2: Evaporator Stack - Emission Rates

Contaminant	EMISSIONS IN VENTING MODE Maximum Rate at 15 t/h (g/s)	Maximum Rate at 36 t/h (g/s)
Acenephthene	0.0002090000	0.000501600
Acrylonitrile	0.0020800000	0.004992000
Aldrin	0.0000005000	0.000001200
Benzene	0.0002630000	0.000631200
Benzo (k) fluoranthene	0.0000041700	0.000010008
Bis (2-chloroethyl) ether	0.0005000000	0.001200000
Butadiene	0.0020800000	0.004992000
Butyl benzyl phthalate	0.0000313000	0.000075120
Carbon tetrachloride	0.0001040000	0.000249600
Chloroform	0.0001040000	0.000249600
Chlorophenol	0.0008330000	0.001999200
Formaldehyde	0.0020800000	0.004992000
Hexachlorobenzene	0.0000041700	0.000010008
Lindane	0.0000001670	0.000000401
Methylene chloride	0.0016700000	0.004008000
PCB	0.0000003130	0.000000751
Perchloroethylene	0.0008330000	0.001999200
Phenol	0.0000833000	0.000199920
Styrene	0.0004170000	0.001000800
Toluene	0.0008330000	0.001999200
Trichloroethylene	0.0041700000	0.010008000
Trichlorophenol, 2,4,6	0.0000167000	0.000040080
Xylene	0.0004170000	0.001000800
Arsenic	0.0000000105	0.000000025
Beryllium	0.0000000011	0.000000003
Cadmium	0.0000000010	0.000000002
Chromium	0.0000001050	0.000000252
Mercury	0.0000000005	0.000000001
Nickel	0.0000001040	0.000000250

considered. As well, handling activities which can create dust include unloading granular materials, loading excavated clay, dozing, scraping, grading, and cover placement. Wind erosion of exposed surfaces was also considered in the assessment. The equations used to calculate the emission factors for each activity listed above were taken from the USEPA Compilation of Air Pollutant Emission Factors (USEPA, 1985) and are provided in Appendix O. An effective control efficiency of 90 percent was assumed for road dust sources and wind erosion of exposed areas.

The controlled emission rates derived for fugitive dust emissions during years 1, 5 and 10 of landfill operation are given in Appendix O. This appendix also includes a breakdown of each emission rate by activity.

The quantitative prediction of dust emission rates is inherently difficult due to general uncertainties in the calculation method and the large number of assumptions necessary, including the precise effect of dust suppression methods. The potential for dust suspension depends on day-to-day and hour-to-hour activities and weather conditions. However,the estimates derived give an indication of the magnitude of the dust quantities which may be suspended during landfilling operations.

Other potential sources of fugitive dust emissions during operation of the OWMC facility include the solidification plant, on-site roads, and ash handling at the incinerator. Emission factors for similar processes were used to estimate particulate emissions from concrete batching in the solidification plant. An emission factor for ash handling at coal-fired thermal power plants was used for the incinerator ash handling operation. Appendix O contains the details of the emission factors assumed, along with the estimated emission rates for these sources.

It is noted that refinements to the current sequence of landfill development and the operations plan are possible. This may change the

associated dust emissions and necessitate a re-evaluation of their effects.

5.2.5 OTHER FUGITIVE EMISSIONS

Potential sources of fugitive organic vapours include unloading of bulk tankers, opening and heating of drums, routine spills from waste transfer, leaks from equipment and vented emissions from waste storage tanks. In addition, volatile organics present in inorganic waste streams may be released from the physical/chemical treatment processes.

Releases of volatile organic wastes have been measured at other hazardous waste landfill sites which contained raw organic wastes in the form of liquids and sludges. These wastes had not undergone treatment or solidification prior to disposal in the landfill sites. In the proposed OWMC facility, only trace quantities of organics are expected to remain in the physical/chemical treatment and incineration residues. These residues will be stabilized prior to landfilling. Because only trace quantities would thus be present in the stabilized residues, hydrocarbon emissions from OWMC's landfill are considered negligible.

Low volatile solid waste, such as contaminated soil, if delivered to the facility in bulk by lugger truck or dump truck, will be stored in enclosed bunkers at the incinerator feed building. Because of the low volatility, little vapour should be emitted and this will be ventilated to the induced air flow of the incinerator combustion air fan. These solid wastes will be stored in the incinerator feed building, where they will be protected from suspension by wind.

The general basis for developing the estimates of fugitive gas emissions from the OWMC facility can be summarized as follows (Monenco, 1987):

- Routine equipment leaks and spills.

  Emission factors for various sources were derived from USEPA's survey of the petroleum refining industry, the synthetic organic-chemical manufacturing industry and the transportation of petroleum liquid. Adjustments were made to reflect the operating conditions of the OWMC facility.

- Handling and processing of waste.

  Emission rates were estimated using a simplified model based on the design and operating philosophy of the facility.

Two sets of emission data were generated based on the above principles, one using a "mix" of organic compounds to represent average or typical emissions, and the other using the maximum expected mass fraction of each compound to represent short-term peak emissions. In the case of the short-term peak emissions, it is assumed that the compound is present throughout the facility in a waste stream which exhibits the highest concentration of that given compound (Environ, 1987). Both average and short-term peak emission rates for waste handling and storage activities are provided in Table 5.3. Only short-term peak emissions were considered for the physical/chemical treatment plant and these emission rates are presented in Table 5.4.

5.2.6 ASSESSMENT OF EMISSIONS CONSIDERING OTHER INDUSTRIAL SOURCES

In this section, emissions from the OWMC incinerator are compared to sources of air pollutants. The OWMC waste incinerator will emit pollutants similar to those of other industrial combustion sources. Combustion products such as sulphur dioxide (SO_2) and nitrogen oxides (NO_x) are released from the combustion of solid, liquid and gaseous fuels (USEPA, 1985). Coal-fired power stations also emit particulates, metals and other compounds which are trace components of the fuel (Edwards et al, 1980).

TABLE 5.3: Organic Unloading/Storage Area - Fugitive Emission Rates

Contaminant	AVERAGE EMISSIONS Waste Unloading and Transfer (g/s)	Drum Opening (g/s)	Drum Heating (g/s)	Storage Tanks (g/s)	Total Leaks and Spills (g/s)	Total Emissions (g/s)
Acetates	1.85E-03	6.99E-05	3.13E-06	3.63E-03	2.06E-03	0.00760213
Acetone	7.51E-02	4.31E-03	9.89E-05	1.47E-01	1.43E-02	0.24119005
Acrylonitrile	3.23E-04	1.84E-05	4.67E-07	6.34E-04	7.88E-05	0.00105386
Alcohols	9.73E-04	2.10E-05	8.59E-07	1.91E-03	2.99E-04	0.00320419
Aldehydes	1.13E-08	4.87E-10	2.92E-11	2.21E-08	4.31E-08	0.00000008
Amines	9.55E-04	8.36E-05	1.45E-06	1.88E-03	1.68E-04	0.00308805
Anhydrides	3.58E-07	1.35E-08	2.21E-09	7.03E-07	1.63E-04	0.00016384
Benzene	1.65E-03	8.31E-05	2.15E-06	3.25E-03	4.68E-04	0.00545433
Benzothiazole	7.08E-08	2.99E-09	2.70E-10	1.39E-07	1.77E-06	0.00000198
Benzo(a)anthracene	5.10E-15	1.46E-16	6.49E-18	1.00E-14	8.73E-07	0.00000087
Benzo(a)pyrene	5.19E-16	1.42E-17	6.36E-19	1.02E-15	3.49E-07	0.00000035
Butadiene	5.73E-04	9.85E-06	1.43E-07	1.13E-03	1.01E-04	0.00180878
Carbon tetrachloride	1.01E-03	4.50E-05	1.09E-06	1.98E-03	2.44E-04	0.00327956
Chlorinated benzenes	3.56E-06	1.52E-07	5.71E-09	6.98E-06	1.99E-06	0.00001269
Chlorinated ethylenes	5.79E-02	2.93E-03	5.80E-05	1.14E-01	1.07E-02	0.18528350
Chloroform	2.88E-03	1.38E-04	3.13E-06	5.66E-03	6.57E-04	0.00934664
Cresols	2.27E-06	9.92E-08	1.26E-08	4.46E-06	4.95E-05	0.00005632
Ethylene glycol	6.55E-05	3.85E-06	6.87E-07	1.29E-04	2.04E-03	0.00224110
Ethylene oxide	3.12E-04	2.27E-05	3.98E-07	6.12E-04	5.51E-05	0.00100156
Formaldehyde	2.56E-04	2.35E-05	8.02E-07	5.03E-04	9.34E-05	0.00087674
Freons	2.76E-01	1.25E-02	1.59E-04	5.41E-01	4.81E-02	0.87749476
Glycerine	4.61E-11	2.27E-12	5.56E-12	9.05E-11	1.27E-05	0.00001265
Hexane	1.45E-02	5.99E-04	1.40E-05	2.85E-02	3.39E-03	0.04700364
Hydrazine	1.22E-08	5.23E-10	2.10E-11	2.40E-08	5.85E-09	0.00000004
Isopropyl alcohol	1.06E-03	5.87E-05	2.65E-06	2.08E-03	3.46E-04	0.00354432
Ketones	3.63E-04	1.19E-05	5.87E-07	7.13E-04	6.92E-04	0.00178061
Methyl ethyl ketone	2.05E-02	9.99E-04	2.47E-05	4.03E-02	5.05E-03	0.06684860
Methyl isobutyl ketone	3.51E-03	1.42E-04	5.19E-06	6.90E-03	1.53E-03	0.01208024
Methylene chloride	6.33E-02	3.56E-03	7.36E-05	1.24E-01	1.16E-02	0.20291943
Naphthalene	1.07E-06	3.82E-08	3.15E-09	2.11E-06	1.78E-05	0.00002100
PCB	2.55E-09	1.37E-11	1.09E-10	5.00E-09	1.24E-04	0.00012436
Perchloroethylene	5.82E-03	2.50E-04	1.13E-05	1.14E-02	2.98E-03	0.02049058
Petroleum distillates	3.17E-03	1.29E-04	5.78E-06	6.23E-03	3.77E-03	0.01331641
Phenol	3.41E-05	1.56E-06	1.39E-07	6.70E-05	2.66E-04	0.00036876
Pyridine	1.87E-04	1.05E-05	3.76E-07	3.66E-04	7.95E-05	0.00064320
Styrene	4.47E-05	1.81E-06	7.94E-08	8.77E-05	3.84E-05	0.00017264
Tetraethyl lead	9.17E-09	3.74E-10	1.11E-10	1.80E-08	2.33E-07	0.00000026
Toluene	9.78E-03	4.47E-04	1.44E-05	1.92E-02	3.69E-03	0.03313108
Trichloroethane	3.89E-02	1.67E-03	5.69E-05	7.65E-02	9.59E-03	0.12671376
Trichloroethylene	2.21E-03	1.04E-04	9.79E-06	4.35E-03	7.75E-04	0.00744752
Trichlorotrifluoroethane	1.28E-01	5.18E-03	1.07E-04	2.51E-01	2.37E-02	0.40769168
Xylene	1.91E-03	7.16E-05	3.28E-06	3.75E-03	1.50E-03	0.00723705
Hydrogen cyanide	1.50E-07	6.80E-08		6.80E-09		0.00000022
Hydrogen sulphide	1.10E-05	2.20E-06				0.00001320

Notes: Average emission rates based on average mass fractions of organics

TABLE 5.3 (contd.): Organic Unloading/Storage Area - Fugitive Emission Rates

SHORT-TERM PEAK EMISSIONS

Contaminant	Waste Unloading and Transfer (g/s)	Drum Opening (g/s)	Drum Heating (g/s)	Storage Tanks (g/s)	Total Leaks and Spills (g/s)	Total Emissions (g/s)
Acetates	3.82E-02	1.45E-03	6.67E-05	3.63E-03	2.06E-03	0.0454003
Acetone	2.59E+00	1.77E-01	1.43E-02	1.47E-01	1.43E-02	2.9454518
Acrylonitrile	2.55E-01	1.48E-02	4.09E-04	6.34E-04	7.88E-05	0.2711709
Alcohols	4.07E-01	8.88E-03	4.00E-04	1.91E-03	2.99E-04	0.4189190
Aldehydes	5.61E-04	2.42E-05	1.46E-06	2.21E-08	4.31E-08	0.0005862
Amines	4.89E-02	4.31E-03	7.60E-05	1.94E-02	1.73E-03	0.0744539
Anhydrides	7.12E-05	2.69E-06	4.40E-07	7.03E-07	1.63E-04	0.0002378
Benzene	4.59E-01	2.35E-02	6.79E-04	3.25E-03	4.68E-04	0.4867872
Benzothiazole	1.31E-04	0.00E+00	0.00E+00	1.39E-07	1.77E-06	0.0001329
Benzo(a)anthracene	4.18E-13	1.19E-14	5.32E-16	1.00E-14	8.73E-07	0.0000009
Benzo(a)pyrene	6.52E-14	1.79E-15	7.99E-17	1.02E-15	3.49E-07	0.0000003
Butadiene	3.02E-02	0.00E+00	0.00E+00	1.13E-03	1.01E-04	0.0313837
Carbon tetrachloride	1.98E+00	9.24E-02	2.91E-03	1.98E-03	2.44E-04	2.0761181
Chlorinated benzenes	0.00E+00	4.38E-05	1.44E-06	6.98E-06	1.99E-06	0.0000544
Chlorinated ethylenes	8.49E+00	5.64E-01	2.91E-02	1.14E-01	1.07E-02	9.2044211
Chloroform	2.46E+00	1.27E-01	4.71E-03	5.66E-03	6.57E-04	2.5966544
Cresols	0.00E+00	6.43E-05	8.20E-06	4.46E-06	4.95E-05	0.0001264
Ethylene glycol	1.46E-03	8.56E-05	1.53E-05	1.29E-04	2.04E-03	0.0037272
Ethylene oxide	1.91E-02	1.40E-03	2.46E-05	6.12E-04	5.51E-05	0.0212137
Formaldehyde	1.65E-02	1.52E-03	5.25E-05	5.03E-04	9.34E-05	0.0186801
Freons	1.76E+01	5.26E+00	2.35E-02	5.41E-01	4.81E-02	23.4596913
Glycerine	7.01E-08	3.45E-09	8.46E-09	9.05E-11	1.27E-05	0.0000127
Hexane	1.58E+00	6.95E-02	2.48E-03	2.85E-02	3.39E-03	1.6807213
Hydrazine	1.94E-02	8.33E-04	3.40E-05	2.40E-08	5.85E-09	0.0202906
Isopropyl alcohol	5.12E-01	2.92E-02	1.94E-03	2.08E-03	3.46E-04	0.5453708
Ketones	4.69E-02	1.54E-03	7.68E-05	7.13E-04	6.92E-04	0.0499203
Methyl ethyl ketone	1.31E+00	6.82E-02	2.67E-03	4.03E-02	5.05E-03	1.4279157
Methyl isobutyl ketone	3.66E-01	1.50E-02	6.05E-04	6.90E-03	1.53E-03	0.3903630
Methylene chloride	6.89E+00	5.64E-01	2.05E-02	1.24E-01	1.16E-02	7.6059960
Naphthalene	3.06E-03	1.09E-04	8.99E-06	2.11E-06	1.78E-05	0.0031964
PCB	4.75E-06	0.00E+00	0.00E+00	5.00E-09	1.24E-04	0.0001291
Perchloroethylene	4.40E-01	1.91E-02	9.45E-04	1.14E-02	2.98E-03	0.4744609
Petroleum distillates	9.88E-02	4.04E-03	1.85E-04	6.23E-03	3.77E-03	0.1130254
Phenol	8.73E-03	4.00E-04	3.59E-05	6.70E-05	2.66E-04	0.0094977
Pyridine	0.00E+00	3.05E-03	1.12E-04	3.66E-04	7.95E-05	0.0036109
Styrene	5.33E-02	2.16E-03	9.66E-05	8.77E-05	3.84E-05	0.0557314
Tetraethyl lead	0.00E+00	1.77E-06	5.26E-07	1.80E-08	2.33E-07	0.0000025
Toluene	4.95E-01	2.31E-02	8.45E-04	1.92E-02	3.69E-03	0.5417145
Trichloroethane	2.50E+00	1.14E-01	1.73E-02	7.65E-02	9.59E-03	2.7139760
Trichloroethylene	1.24E+00	6.01E-02	1.83E-02	4.35E-03	7.75E-04	1.3284352
Trichlorotrifluoroethane	8.29E+00	4.39E-01	2.28E-02	2.51E-01	2.37E-02	9.0256937
Xylene	1.41E-01	5.32E-03	2.55E-04	3.75E-03	1.50E-03	0.1522885
Hydrogen cyanide	1.60E-05	4.00E-07		6.80E-09		0.0000164
Hydrogen sulphide	9.70E-04	1.30E-05				0.0009830

Notes:

Short-term peak emission rates based on maximum mass fractions in any waste stream (storage tank emissions and leaks and spills based on average mass fractions)

TABLE 5.4: Physical Chemical Treatment Plant - Fugitive Emission Rates

SHORT-TERM PEAK EMISSIONS

Contaminant	DAF Unit (g/s)	Emulsion Breaking (g/s)	Cyanide Treatment (g/s)	Sulphide Treatment (g/s)	Other (g/s)	Total Emissions (g/s)
Acetates	1.62E-04	2.97E-02				0.029840
Acetone	0.00E+00	0.00E+00				0
Acrylonitrile	1.09E-03	1.98E-01				0.199364
Alcohols	1.73E-03	3.17E-01				0.318261
Aldehydes	2.38E-06	4.35E-04				0.000438
Amines	2.08E-04	3.80E-02				0.038220
Anhydrides	0.00E+00	0.00E+00				0
Benzene	3.46E-06	6.33E-04				0.000636
Benzothiazole	0.00E+00	0.00E+00				0
Benzo(a)anthracene	1.08E-16	1.97E-14				1.98E-14
Benzo(a)pyrene	1.10E-17	2.00E-15				2.01E-15
Butadiene	1.28E-04	2.34E-02				0.023557
Carbon tetrachloride	0.00E+00	0.00E+00				0
Chlorinated benzenes	0.00E+00	0.00E+00				0
Chlorinated ethylenes	3.61E-02	6.59E+00				6.629450
Chloroform	0.00E+00	0.00E+00				0
Cresols	0.00E+00	0.00E+00				0
Ethylene glycol	0.00E+00	0.00E+00				0
Ethylene oxide	0.00E+00	0.00E+00				0
Formaldehyde	7.02E-05	1.28E-02				0.012901
Freons	3.64E-04	6.66E-02				0.066927
Glycerine	0.00E+00	0.00E+00				0
Hexane	0.00E+00	0.00E+00				0
Hydrazine	0.00E+00	0.00E+00				0
Isopropyl alcohol	2.18E-03	3.98E-01				0.399770
Ketones	0.00E+00	0.00E+00				0
Methyl ethyl ketone	0.00E+00	0.00E+00				0
Methyl isobutyl ketone	0.00E+00	0.00E+00				0
Methylene chloride	0.00E+00	0.00E+00				0
Naphthalene	2.26E-08	4.12E-06				0.000004
PCB	0.00E+00	0.00E+00				0
Perchloroethylene	1.87E-03	3.42E-01				0.343725
Petroleum distillates	4.20E-04	7.68E-02				0.077170
Phenol	3.71E-05	6.78E-03				0.006818
Pyridine	0.00E+00	0.00E+00				0
Styrene	2.27E-04	4.14E-02				0.041673
Tetraethyl lead	0.00E+00	0.00E+00				0
Toluene	2.10E-03	3.84E-01				0.386588
Trichloroethane	4.28E-05	7.81E-03				0.007856
Trichloroethylene	3.43E-06	6.27E-04				0.000631
Trichlorotrifluoroethane	5.28E-05	9.64E-03				0.009694
Xylene	6.02E-04	1.10E-01				0.110500
Ammonia					1.670000	1.670000
Hydrogen cyanide			0.000003	0		0.000003
Hydrogen sulphide			0	0		0

Table 5.5 summarizes the emissions from various combustion sources, including the OWMC incinerator. The OWMC emissions are based on the expected pollutant flue gas concentrations, an average flue gas flowrate of 22 860 Nm^3/h (50 percent excess air, dry basis) and an annual operating time of 7 000 hours. In order to compare the different sources on a common basis, boilers which generate the same thermal energy and a municipal waste incinerator with the same capacity as the OWMC incinerator were selected. One hundred residential wood stoves and 100 highway vehicles were also selected, since these produce similar quantities of the pollutants of interest. There are approximately 209 000 actively used wood stoves (ORF, 1984b) and approximately 3.7 million registered automobiles (Statistics Canada, 1981) in Ontario.

Based on the data in Table 5.5, the OWMC incinerator will emit, on an annual basis, a quantity of hydrocarbons similar to that emitted by coal-fired and oil-fired boilers of equivalent heat input, and 100 automobiles. It will emit approximately 1/10 of the hydrocarbons of an equivalent municipal refuse incinerator and 1/5 of the hydrocarbons from 100 automobiles. Sulphur dioxide emissions will be one and two orders of magnitude less than the coal and oil-fired boilers, respectively, and similar to those of a municipal refuse incinerator. Nitrogen oxide emissions will also be similar to those of a municipal refuse incinerator and one order of magnitude less than those of the boilers. Particulate emissions will be similar to those of the refuse incinerator and 100 residential woodstoves, and one and two orders of magnitude less than emissions from the coal and oil-fired boilers, respectively. Hydrogen chloride emissions will be similar to the refuse incinerator. Lead and zinc emissions will also be similar to the refuse incinerator, but orders of magnitude greater than a coal-fired boiler. Mercury emissions will be 10 times greater than those of the coal-fired boiler.

Other researchers have examined specific organic compound emissions which result from the burning of hazardous wastes in incinerators, boilers and cement kilns (Oppelt, 1987). These emissions,

TABLE 5.5

Air Pollutant Emission Rates for the OWMC Incinerator and Other Combustion Sources

Pollutant/ Parameters	OWMC Incinerator	Coal-Fired Boiler (1,2)	Oil-Fired Boiler (1)	Municipal Refuse Incinerator (1,2,4,5)	100 Residential Woodstoves (1)	100 Automobiles (1,3)
	Emission Rates (t/a)					
Pollutants						
Total Hydrocarbons	2.40	1.54	3.76	23.3	11.6	5.0
Sulphur Dioxide	24.0	550	2880	38.8	NA	NA
Nitrogen Oxides	32.0	390	730	46.6	NA	NA
Particulate	2.4	14.0	140	8.7	4.75	NA
Hydrogen Chloride	2.4	NA	NA	1.1	NA	NA
Lead	0.80	0.005	NA	0.25	NA	0.086
Zinc	0.80	0.005	NA	0.98	NA	NA
Mercury	0.032	0.003	NA	NA	NA	NA
Dioxins	0.0000008	NA	NA	0.00053	NA	NA
Furans	0.000004	NA	NA	0.00054		
Source Parameters						
Feedrate (t/a)	30,000			30,000	230	
Heat Input (MW)	18.5	18.5	18.5			
Kilometres travelled (km/a)						1900000

Notes:
NA literature data not available or pollutant not applicable
Sources: 1. USEPA, 1985
2. Edwards et al, 1980
3. Environment Canada, 1978
4. Environment Canada, 1985
5. ORF, 1986

together with those expected from the OWMC incinerator, are summarized in Table 5.6. The OWMC incinerator emissions are for average conditions and should be compared to the mean values presented for other waste incineration technologies. On this basis, the OWMC incinerator emissions are generally much lower than the emissions from other industrial waste incineration technologies. It should be noted, however, that the reported emissions are extremely variable and range from zero to thousands of nanograms (ng) of emission per kilojoules (kJ) of heat input. OWMC incinerator emission estimates for the compounds presented range from less than 1 to 9 ng per kJ of heat input.

5.3 EFFECTS ON AMBIENT AIR QUALITY DURING NORMAL OPERATION

5.3.1 DISPERSION OF EMISSIONS

5.3.1.1 Stack Emissions

For the purpose of assessing compliance with Regulation 308 under the Environmental Protection Act, emissions from the incinerator and evaporator stack were modelled using dispersion modelling procedures as outlined in Regulation 308 (for details see Appendix K), which include calculation of maximum 1/2-hour point-of-impingement concentrations. Specific stack parameters are discussed in Appendices M and N and the locations of each stack are illustrated in Figure 5.1. The maximum concentrations, and the distances from each source at which these occur, are summarized in Table 5.7. Figure 5.2 shows the variations of the maximum concentration with distance from the source.

In addition to the dispersion modelling required under Regulation 308, the dispersion of emissions from these point sources was calculated over the short-term (hourly) time period using a general Gaussian plume model, and over the long-term (annual and seasonal) using the Industrial Source Complex (ISC) model (see Appendix K for model details).

TABLE 5.6

Organic Compound Emission Rates for the
OWMC Incinerator and Other
Industrial Waste Incineration Technologies

	Emission Rates (ng/kJ)**						
		Industrial Waste Incinerators*		Boilers*		Cement Kilns*	
Compound	OWMC Incinerator	Mean	Range	Mean	Range	Mean	Range
Benzene	0.45	87	2-980	30	0-300	580	290-1000
Toluene	9.0	1.6	1.5-4.1	280	0-1200	NA	NA
Carbon tetra-chloride	0.02	0.8	0.3-1.5	1.8	0-7.2	NA	NA
Chloroform	0.04	3.8	0.5-8.4	120	0-1700	NA	NA
Methylene chloride	3.7	2.2	0-9.6	180	0-5800	NA	NA
Trichloro-ethylene	1.6	5.2	2.3-9.1	1.2	0-13	1.3	0.7-2.8
Phenol	1.8	7.8	0-16	0.3	0-0.8	0.02	0-0.05

Notes:

NA literature data not available

* Source - Oppelt, 1987

** Nanograms of emission per kilojoules of heat input

FIGURE 5·1 OWMC SITE SKETCH - LOCATIONS OF STACKS

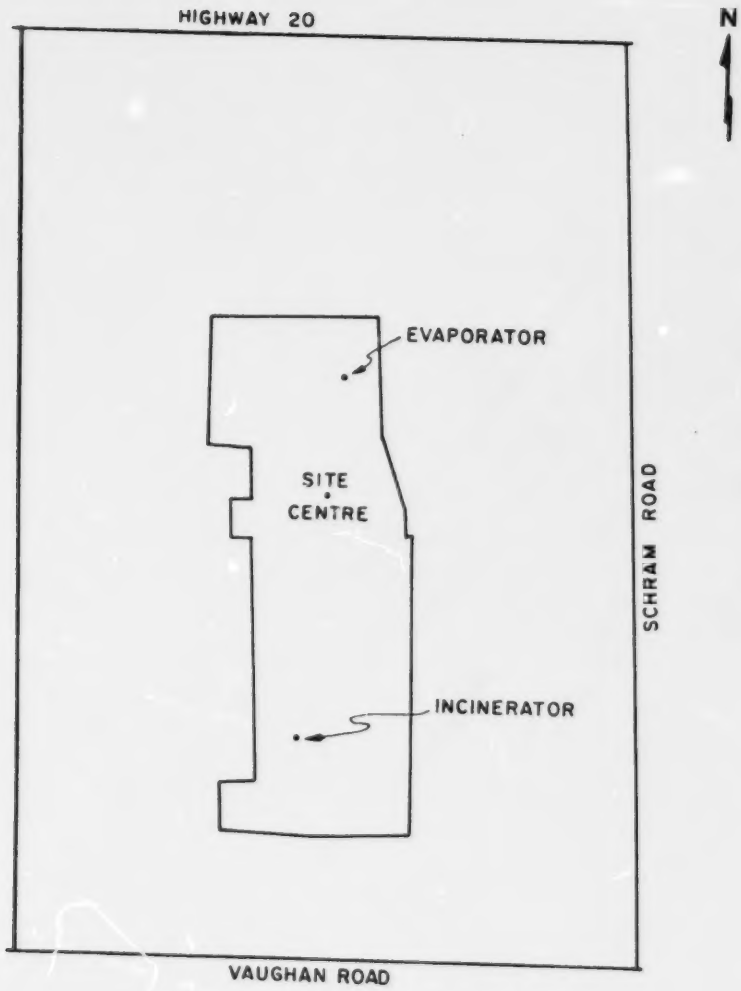


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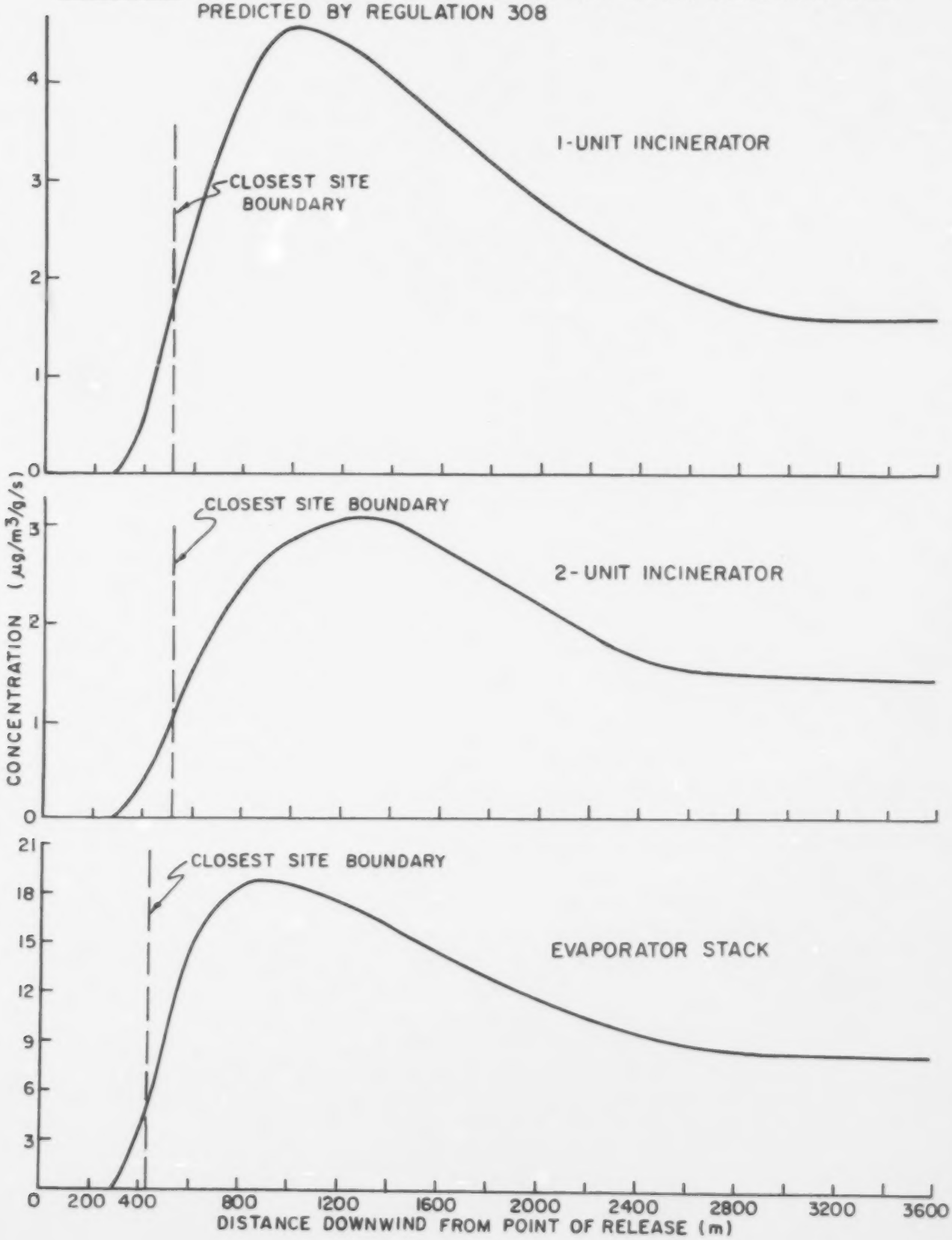
TABLE 5.7

Dispersion Modelling Results for Stack Emissions

	Concentrations ($\mu g/m^3/g/s$)		
	Incinerator (1-Unit)	Incinerator (2-Unit)	Evaporator (Stack)
Max. 1/2-hour Reg. 308	4.56 (@ 1050 m)	3.08 (@ 1300 m)	19.2 (@ 900 m)
Max. 1-hour	34.5 (@ 1500 m)	23.6 (@ 2000 m)	34.8 (@ 430 m)
Max. Annual	0.057 (@ 1800 m) (N winds)	0.034 (@ 2500 m) (N winds)	0.25 (@ 700 m) (N winds)

FIGURE 5.2 MAXIMUM 1/2 HR POINT-OF-IMPINGEMENT STACK CONCENTRATIONS PREDICTED BY REGULATION 308



The short-term (hourly) maximum concentrations were predicted to occur under inversion breakup fumigation conditions for the incinerator stack and under extremely unstable conditions for the evaporator. Table 5.7 also presents these maximum concentrations.

The spatial variations of the annual and seasonal long-term concentrations around the preferred site are illustrated in Figures 5.3 to 5.8, inclusive. The maximum concentrations are summarized in Table 5.7.

5.3.1.2 Fugitive Emissions

The dispersion of fugitive emissions during operation of the OWMC facility has been estimated by combining sources in a given working area. The landfill was treated as a 250 m x 250 m area (with excavation activities taking place within a 250 x 140 m area and filling operations within a 250 x 110 m area). The organic storage area was assumed to be 230 m x 100m, the physical/chemical treatment area 220 m x 70 m, and the incinerator area 95 m x 45 m. Figure 5.9 illustrates the locations of these sources within the OWMC site. Off-site emissions due to vehicle traffic were modelled separately as a line source.

The dispersion of emissions from these four area sources was calculated over the short-term (1-hour) and long-term (seasonal and annual) time periods using two dispersion models. Calculations of maximum 1/2-hour point-of-impingement concentrations for the physical/chemical treatment and organic storage areas were undertaken as prescribed in Regulation 308. As well, vehicle emissions were calculated over the short-term using a Gaussian model modified for a line source. The long-term modelling was carried out using the USEPA's Industrial Source Complex (ISC) model. Details of these models are provided in Appendix K.

The results of the Regulation 308 calculations, in terms of maximum 1/2-hour point-of-impingement concentrations, are provided in Table 5.8 for the relevant fugitive emission sources.

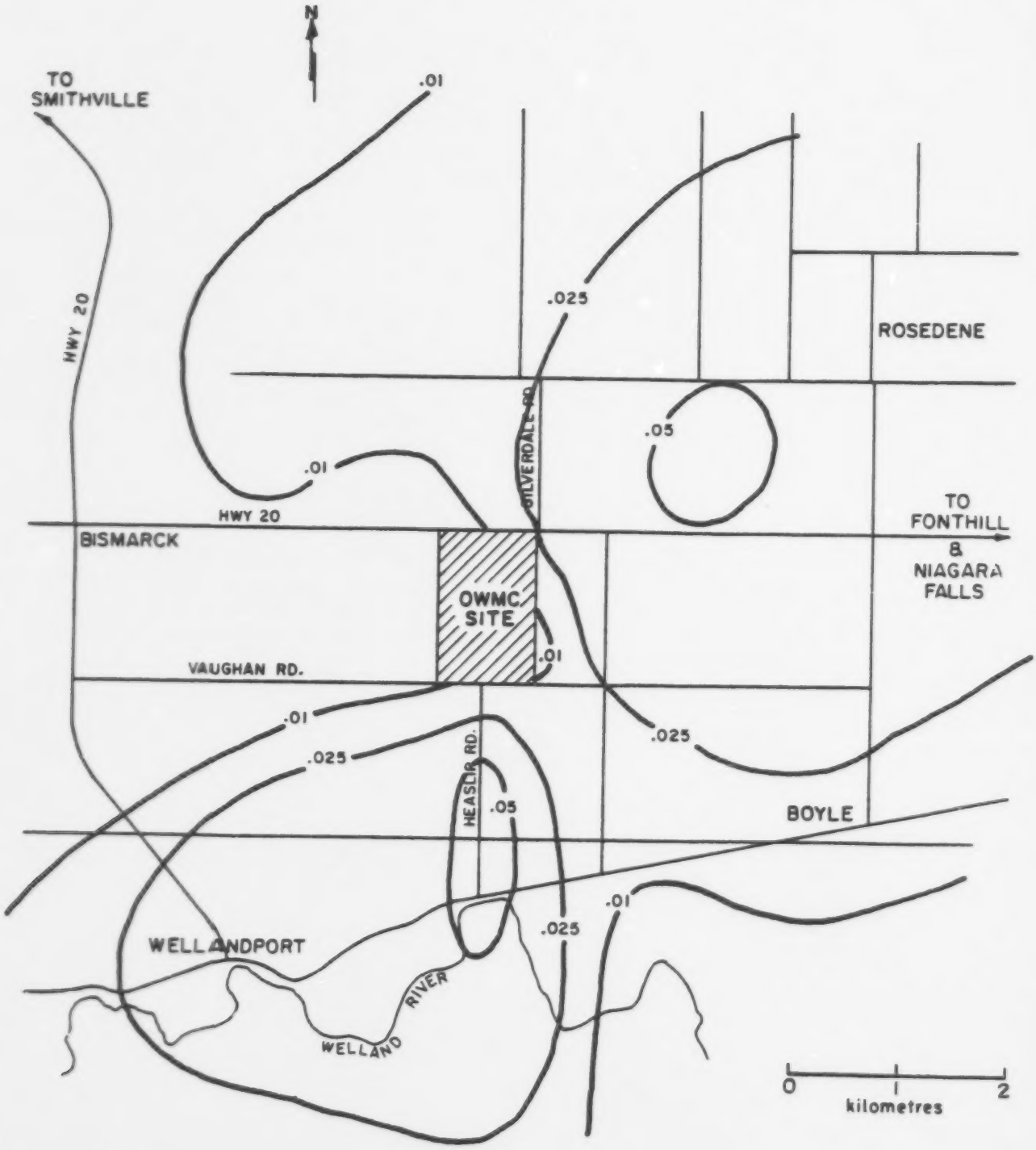


FIG. 5.3 ANNUAL AVERAGE GROUND LEVEL CONCENTRATIONS ($\mu g/m^3/g/s$)
INCINERATOR STACK (I UNIT)

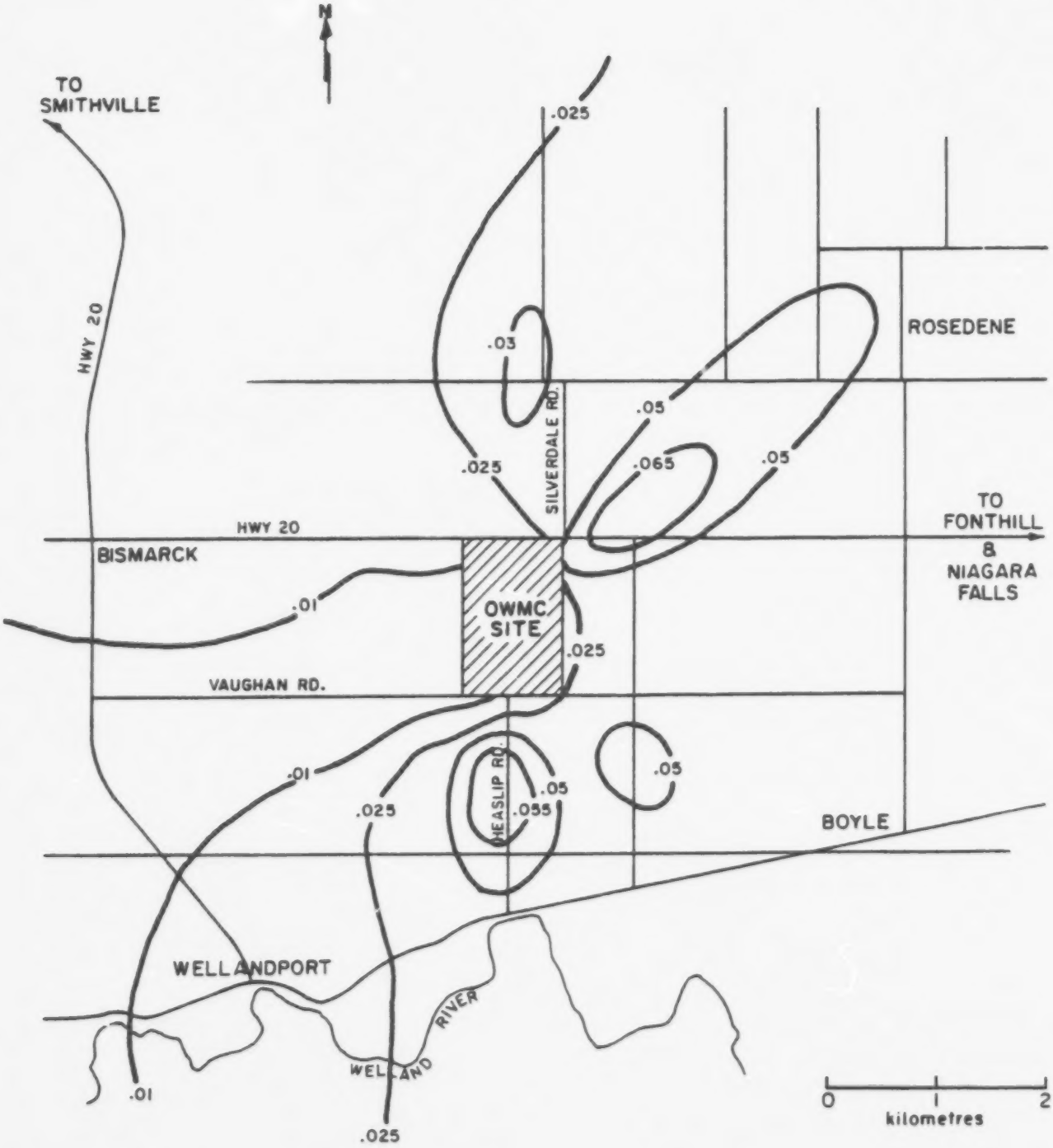


FIG. 5.4 SUMMER AVERAGE GROUND LEVEL CONCENTRATIONS ($\mu g/m^3/g/s$)
INCINERATOR STACK (1 UNIT)

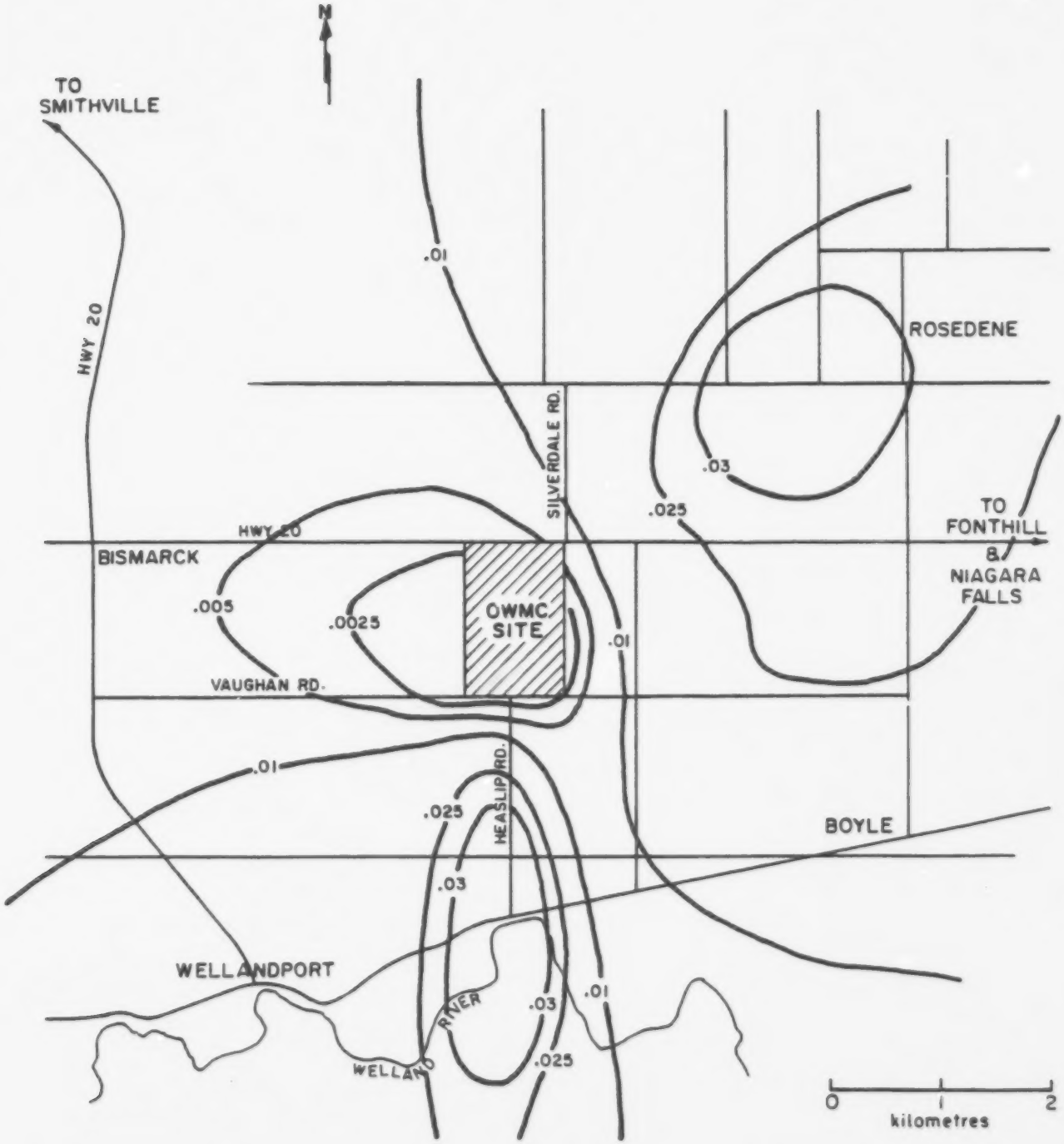


FIG. 5.5 ANNUAL AVERAGE GROUND LEVEL CONCENTRATIONS ($\mu g/m^3/g/s$)
INCINERATOR STACK (2 UNITS)

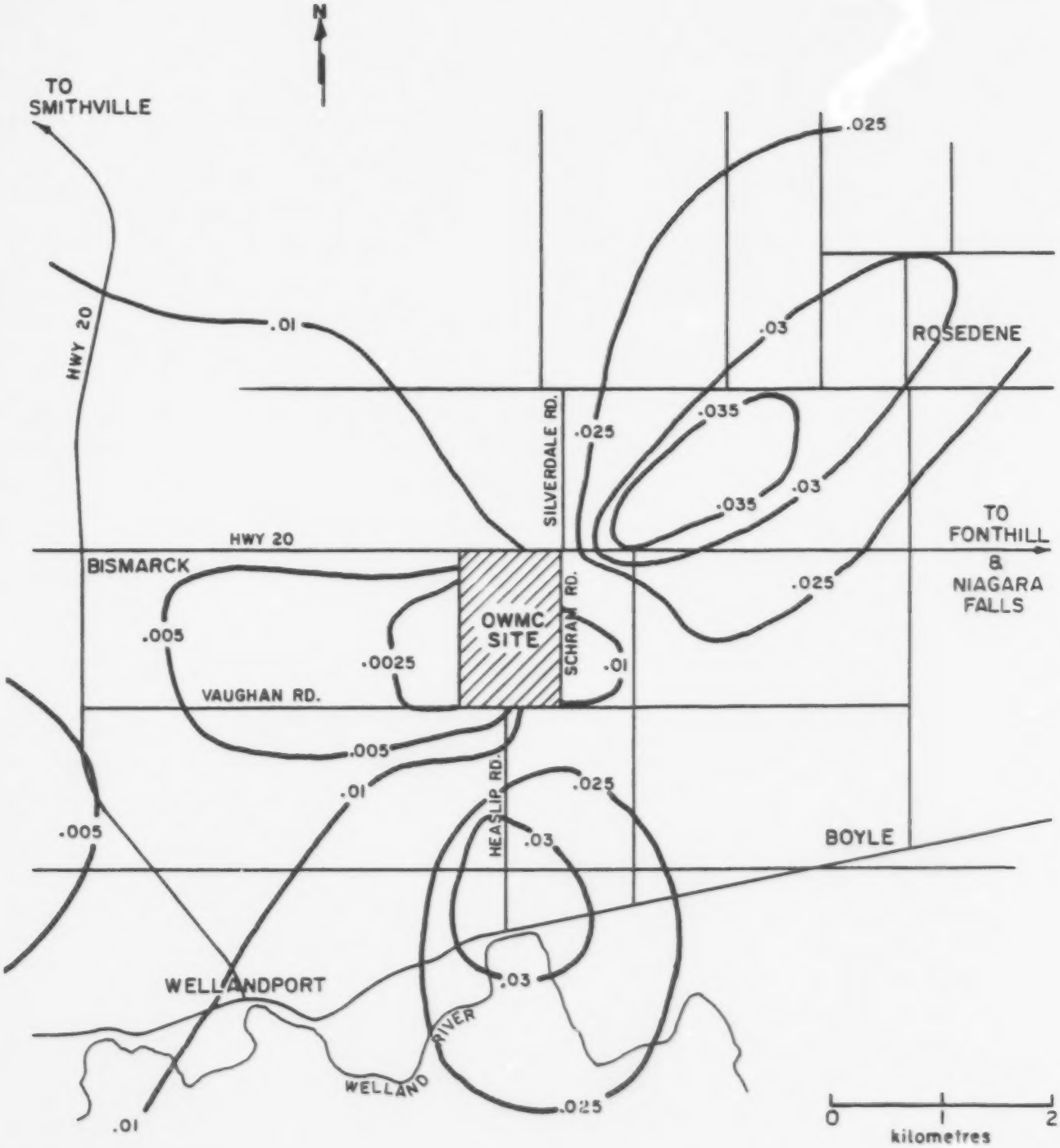


FIG. 5.6 SUMMER AVERAGE GROUND LEVEL CONCENTRATIONS ($\mu g/m^3/g/s$)
INCINERATOR STACK (2 UNITS)

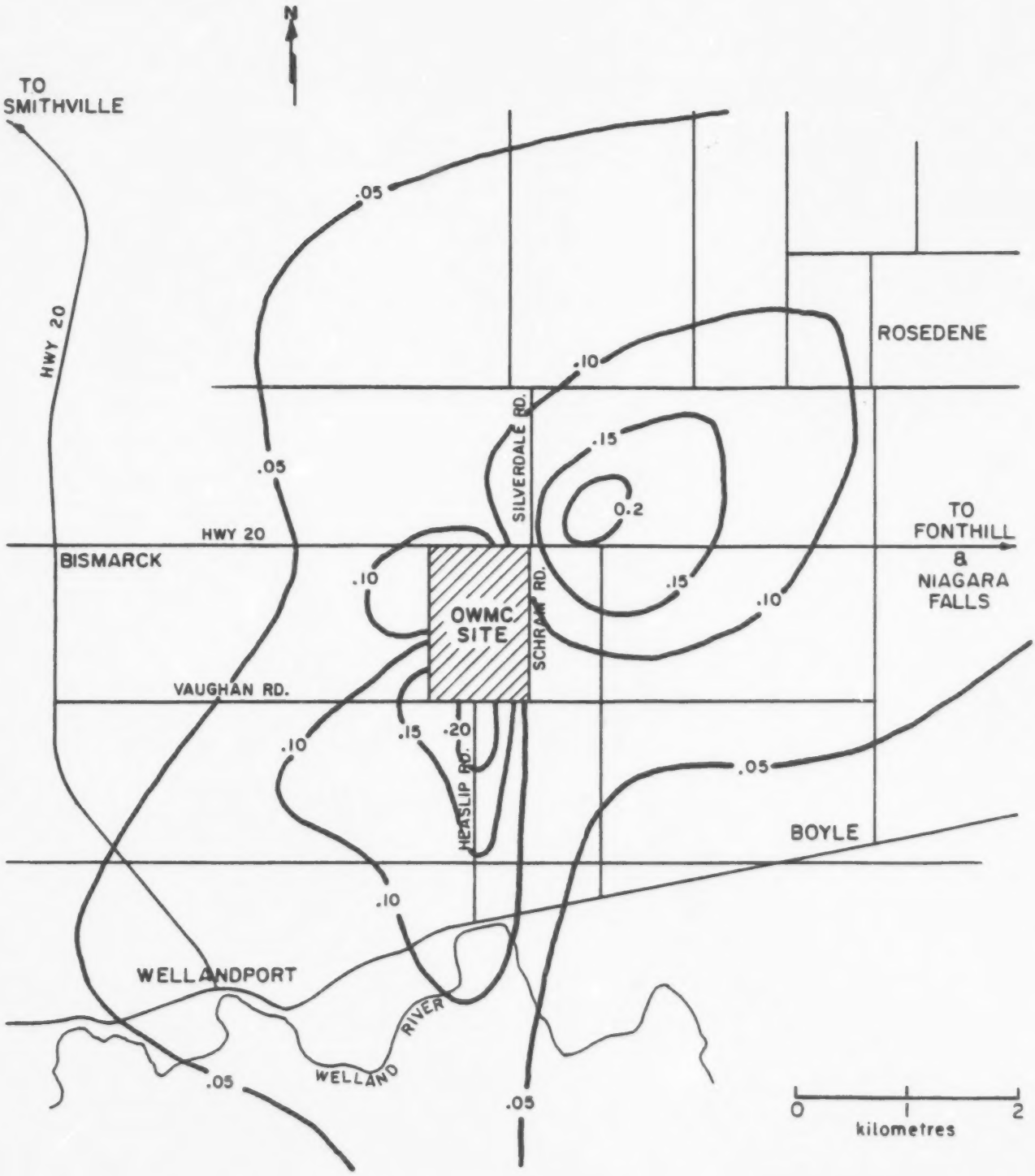


FIG. 5.7 ANNUAL AVERAGE GROUND LEVEL CONCENTRATIONS ($\mu g/m^3/g/s$) EVAPORATOR STACK

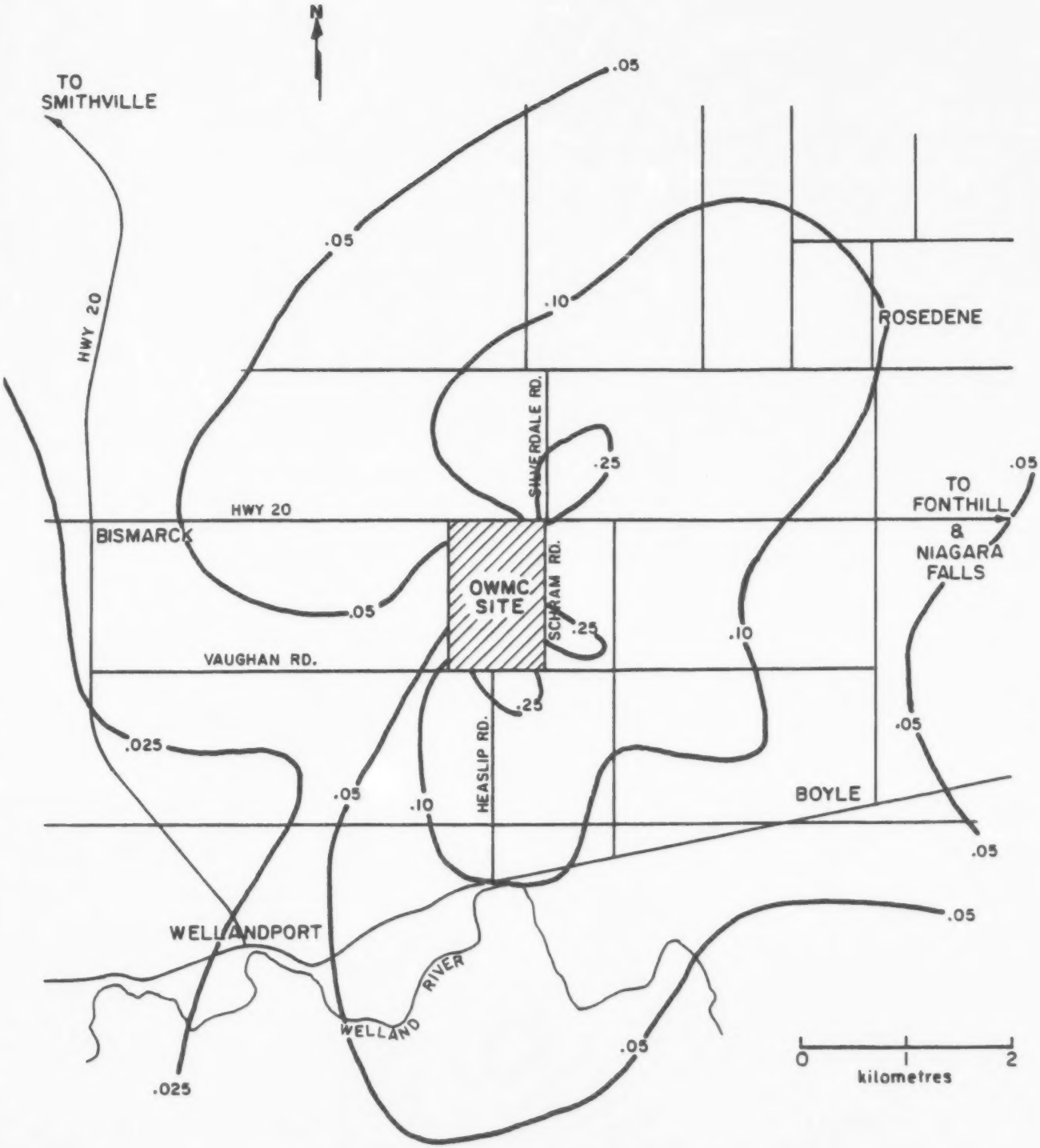


FIG. 5.8 SUMMER AVERAGE GROUND LEVEL CONCENTRATIONS ($\mu g/m^3/g/s$)
EVAPORATOR STACK

FIG. 5.9 OWMC SITE LAYOUT SHOWING FUGITIVE EMISSION SOURCES.

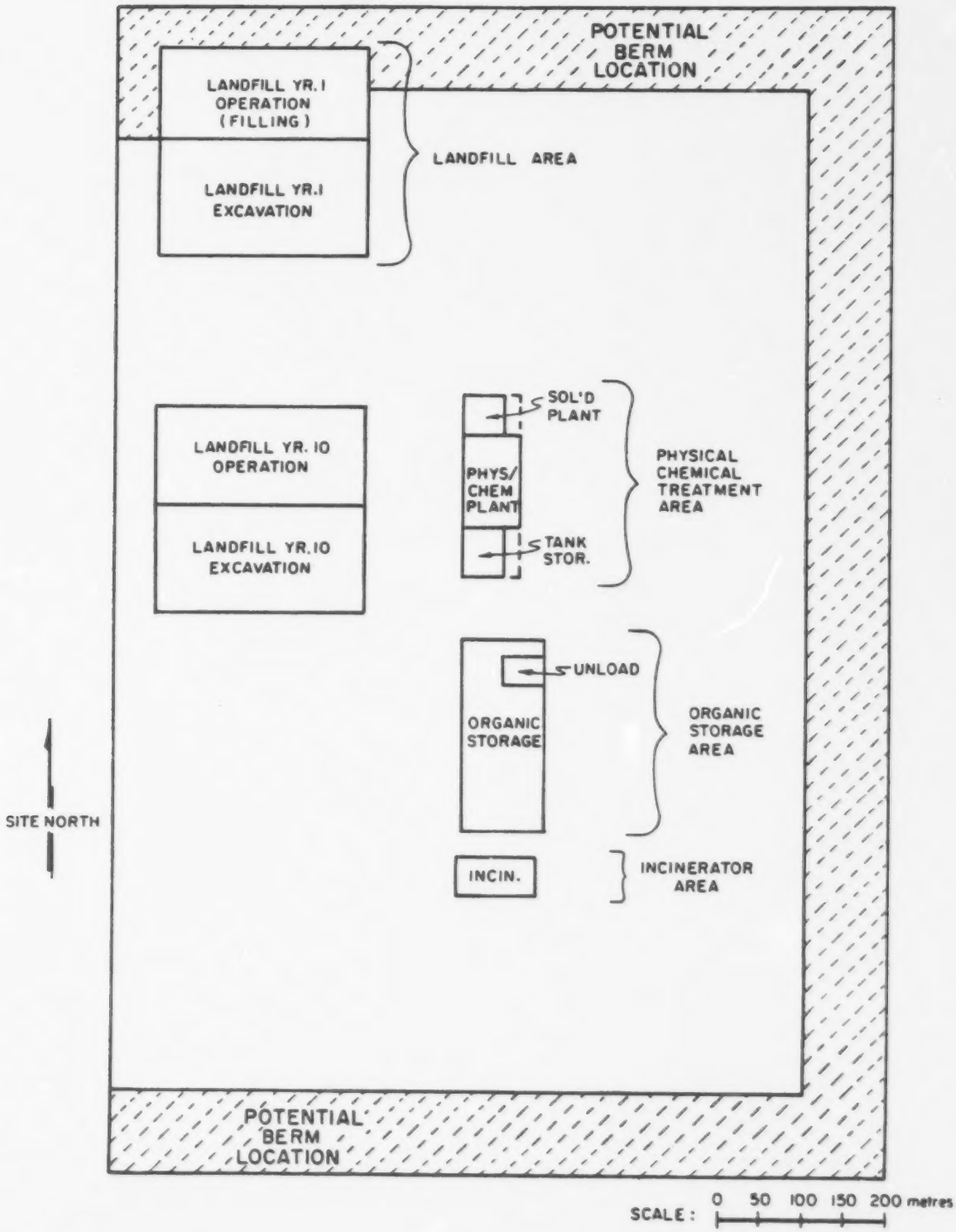


TABLE 5.8

Dispersion Modelling Results for Fugitive Emissions

	Concentrations ($\mu g/m^3/g/s$)			
	Organic Unloading and Storage Area	Phys/Chem. Treatment Plant Area	Incinerator Area	Landfill Operation and Excavation Areas
Max. 1/2-hour Reg. 308	39 (@ 525 m)	28 (@ 575 m)	NA	NA
Max. 1-hour	796 (@ south boundary)	550 (@ north boundary)	155 (@ south boundary)	370 (Operation) 310 (Excavation) (@ west boundary)
Max. Annual	3 (SW winds)	2 (SW winds)	5 (SW winds)	15 (S-SW winds)

Note:

NA not applicable

The short-term (hourly) analysis was intended to represent a worst-case situation. Figures 5.10 and 5.11 present plots of maximum hourly concentration versus distance for each of the four fugitive sources considered, assuming a unit emission rate of 1 g/s for each source. The maximum 1-hour concentrations predicted at the site boundaries are presented in Table 5.8.

The predicted long-term concentration patterns due to the landfill operations are illustrated in Figure 5.12 (annual) and Figure 5.13 (summer). Maximum levels are expected to occur adjacent to the north site boundaries when the landfilling operations are taking place in the northwest corner of the site. These maximum levels are summarized in Table 5.8.

Figures 5.14 and 5.15 show the annual and summer concentration patterns due to emissions from the organic unloading and storage area. Maximum levels are expected to occur at the northeast border during the annual and summer periods.

The annual and summer average concentration patterns for the physical/chemical treatment area are illustrated in Figures 5.16 and 5.17. Similarly, Figures 5.18 and 5.19 show the predicted annual and summer concentration patterns due to fugitive emissions from the incinerator area.

5.3.2 INCREMENTAL EFFECTS ON LOCAL AIR QUALITY

5.3.2.1 Off-Site Vehicles

Short-term (1-hour) concentrations of TSP, CO, NO_x and HC were derived for off-site vehicle traffic attributable to the operation of the OWMC facility. Concentrations due to the predicted traffic (without the OWMC facility) in 1995 were also modelled. Tables 5.9 and 5.10 contain these results for two atmospheric dispersion conditions, i.e., Pasquill Stability Class D with a 3 m/s wind (commonly occurring) and Stability

FIG. 5.10 SHORT TERM (1-HOUR) CONCENTRATIONS DUE TO FUGITIVE EMISSION SOURCES - OPERATIONS.

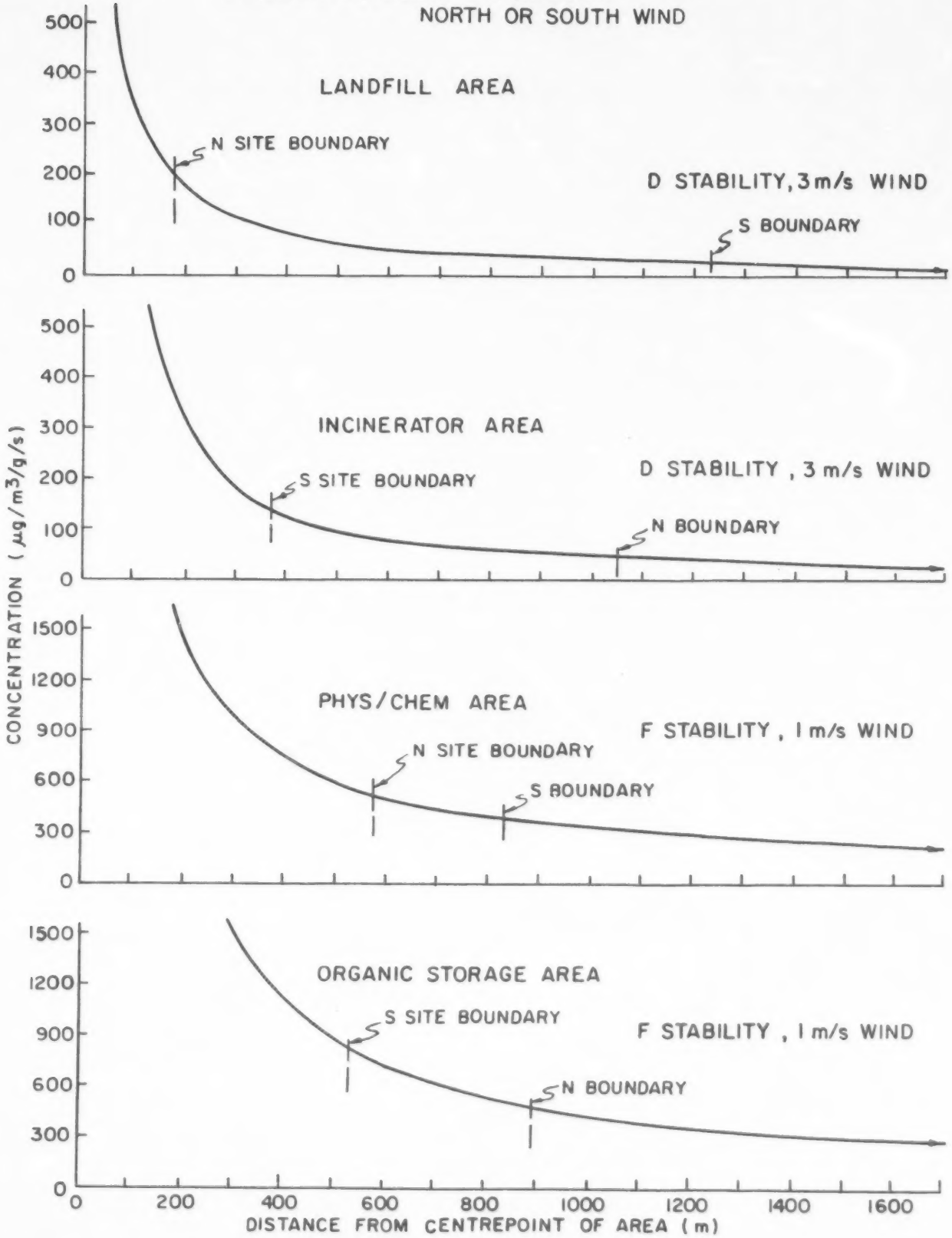
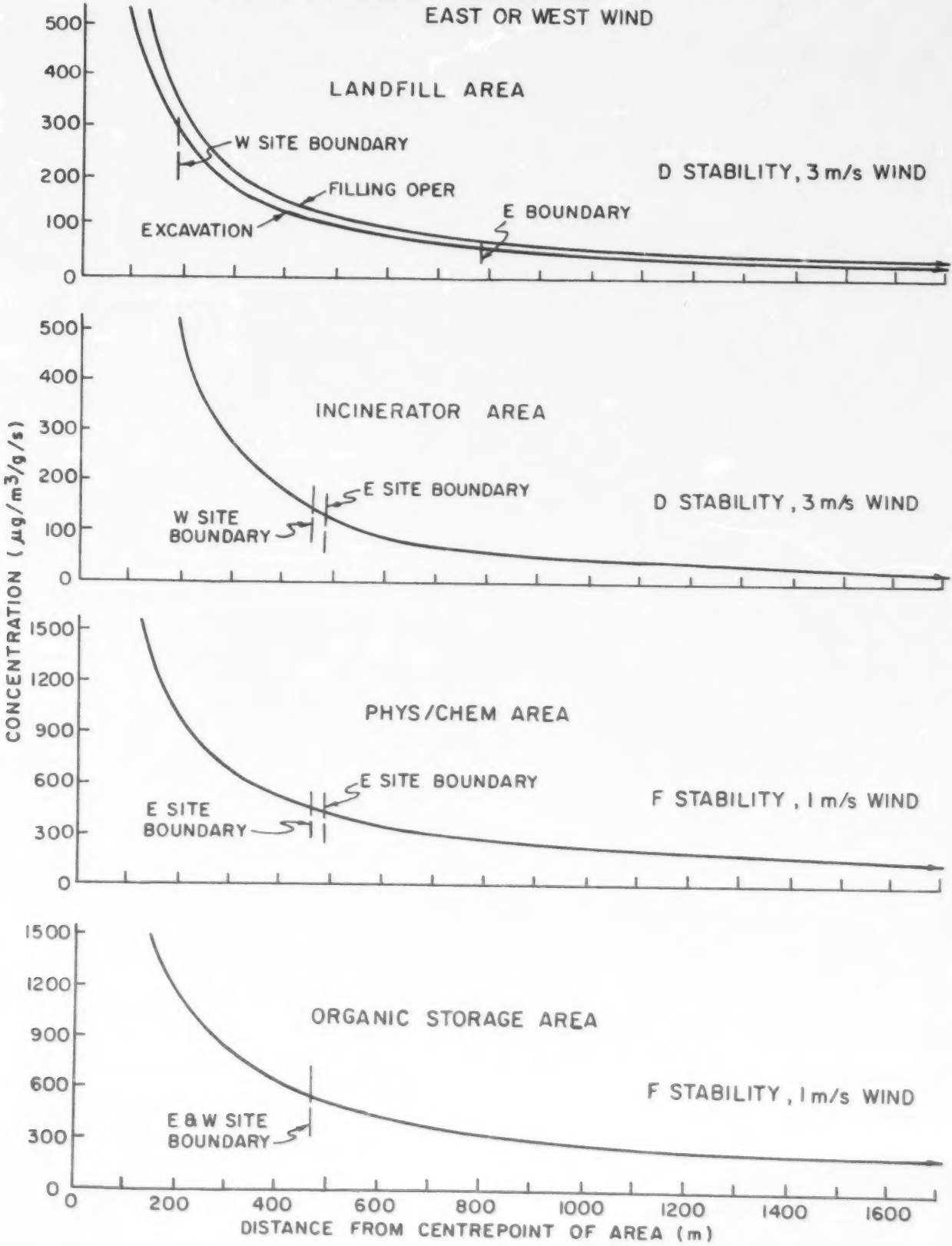


FIG. 5.11 SHORT TERM (1-HOUR) CONCENTRATIONS DUE TO FUGITIVE EMISSION SOURCES - OPERATIONS.



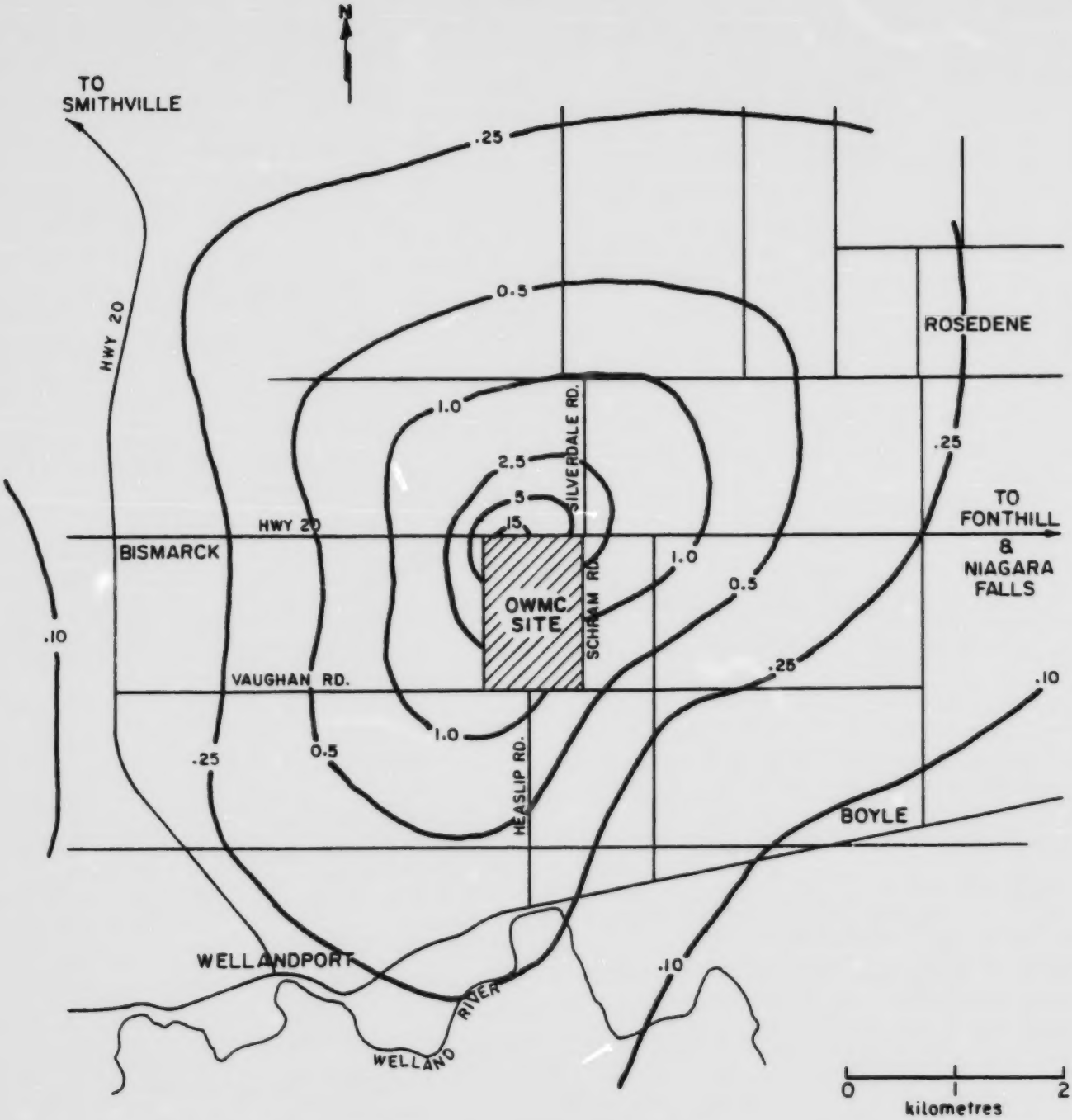


FIG. 5.12 ANNUAL AVERAGE GROUND LEVEL CONCENTRATIONS ($\mu g/m^3/g/s$)
LANDFILL EMISSIONS

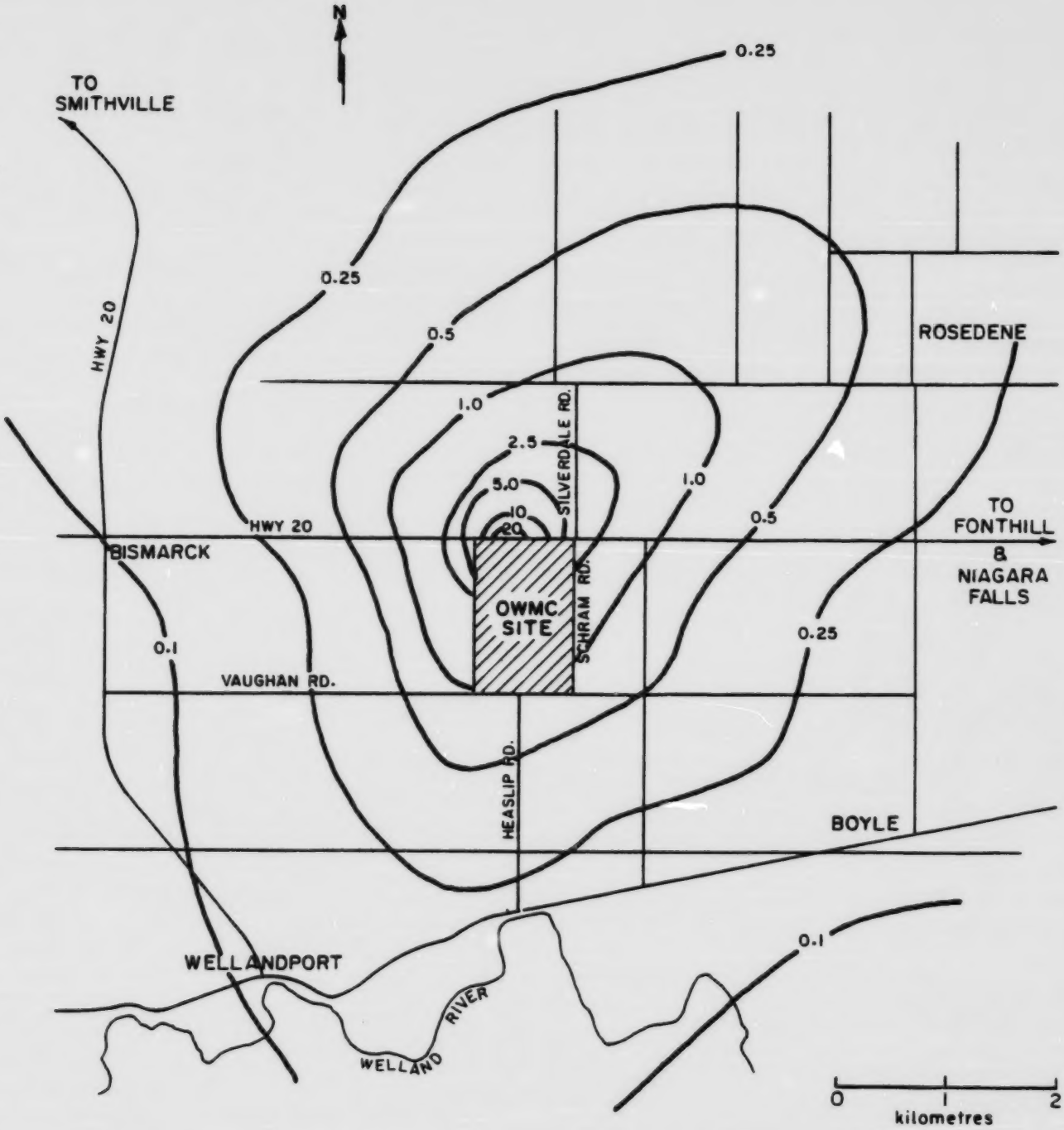


FIG. 5.13 SUMMER AVERAGE GROUND LEVEL CONCENTRATIONS ($\mu g/m^3/g/s$) LANDFILL EMISSIONS

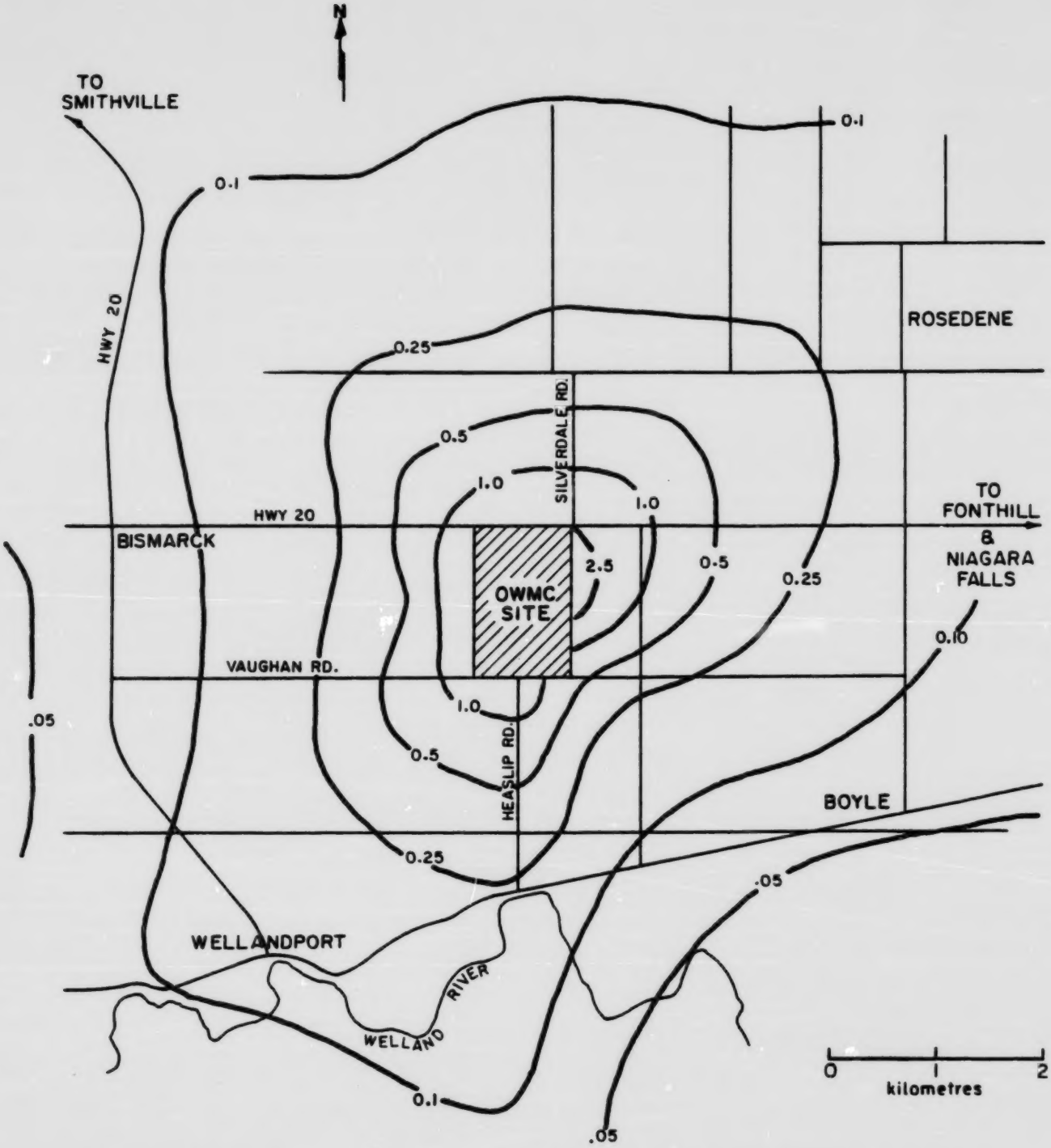


FIG. 5.14 ANNUAL AVERAGE GROUND LEVEL CONCENTRATIONS ($\mu g/m^3/g/s$)
ORGANIC STORAGE AREA - FUGITIVE EMISSIONS

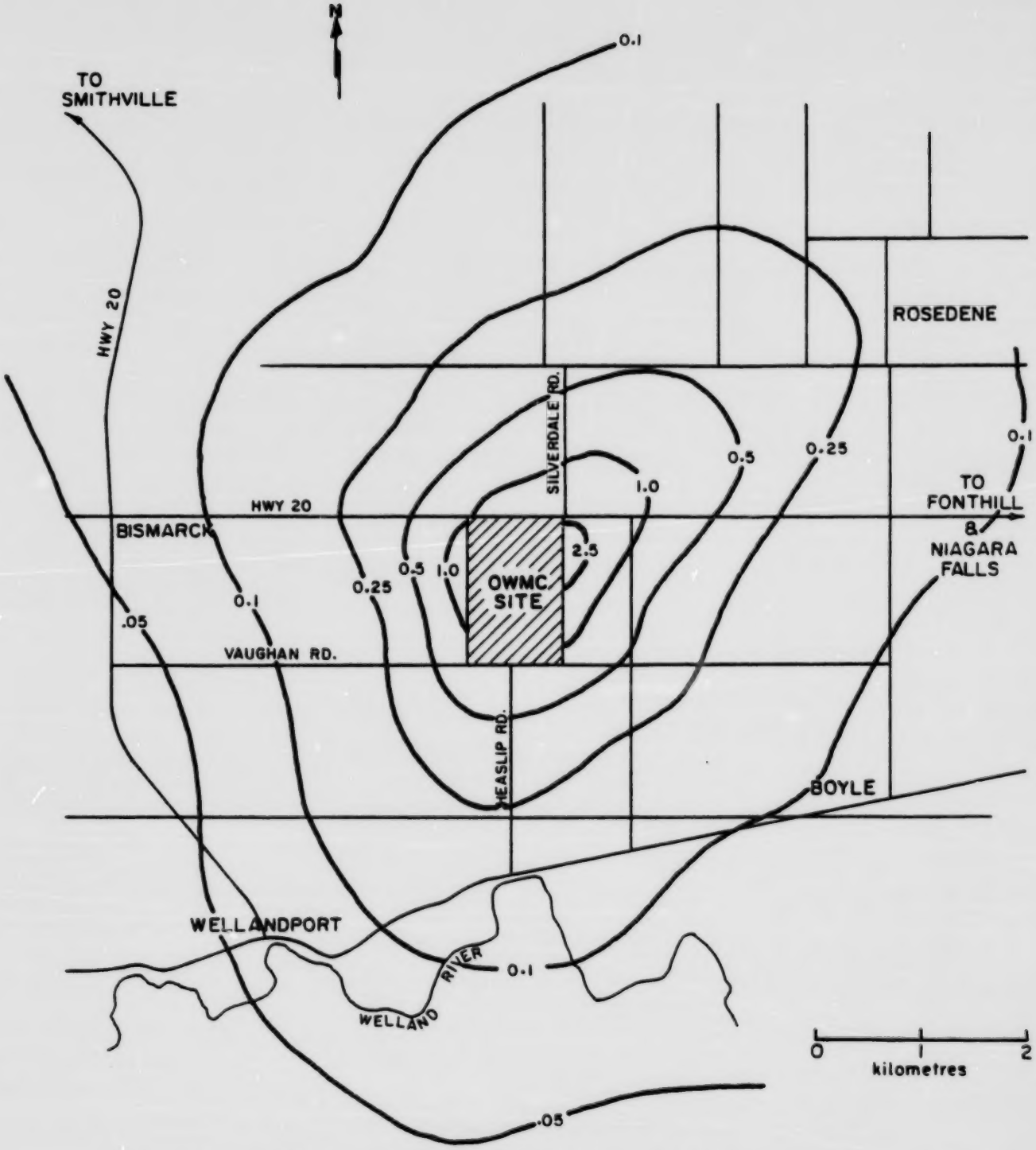


FIG. 5.15 SUMMER AVERAGE GROUND LEVEL CONCENTRATIONS ($\mu g/m^3/g/s$)
ORGANIC STORAGE AREA - FUGITIVE EMISSIONS

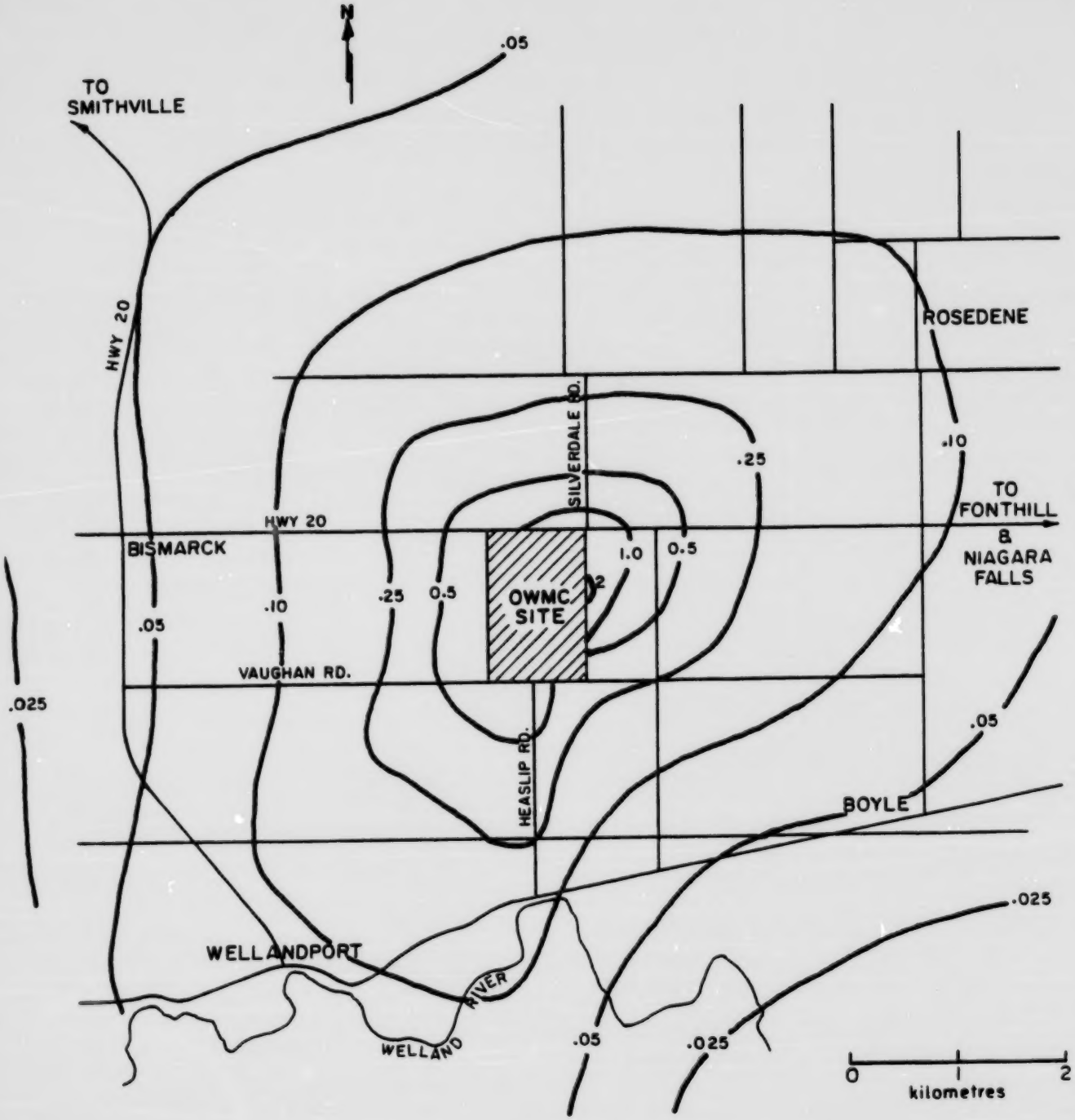


FIG. 5.16 ANNUAL AVERAGE GROUND LEVEL CONCENTRATIONS ($\mu g/m^3/g/s$)
PHYSICAL/CHEMICAL TREATMENT PLANT - FUGITIVE EMISSIONS

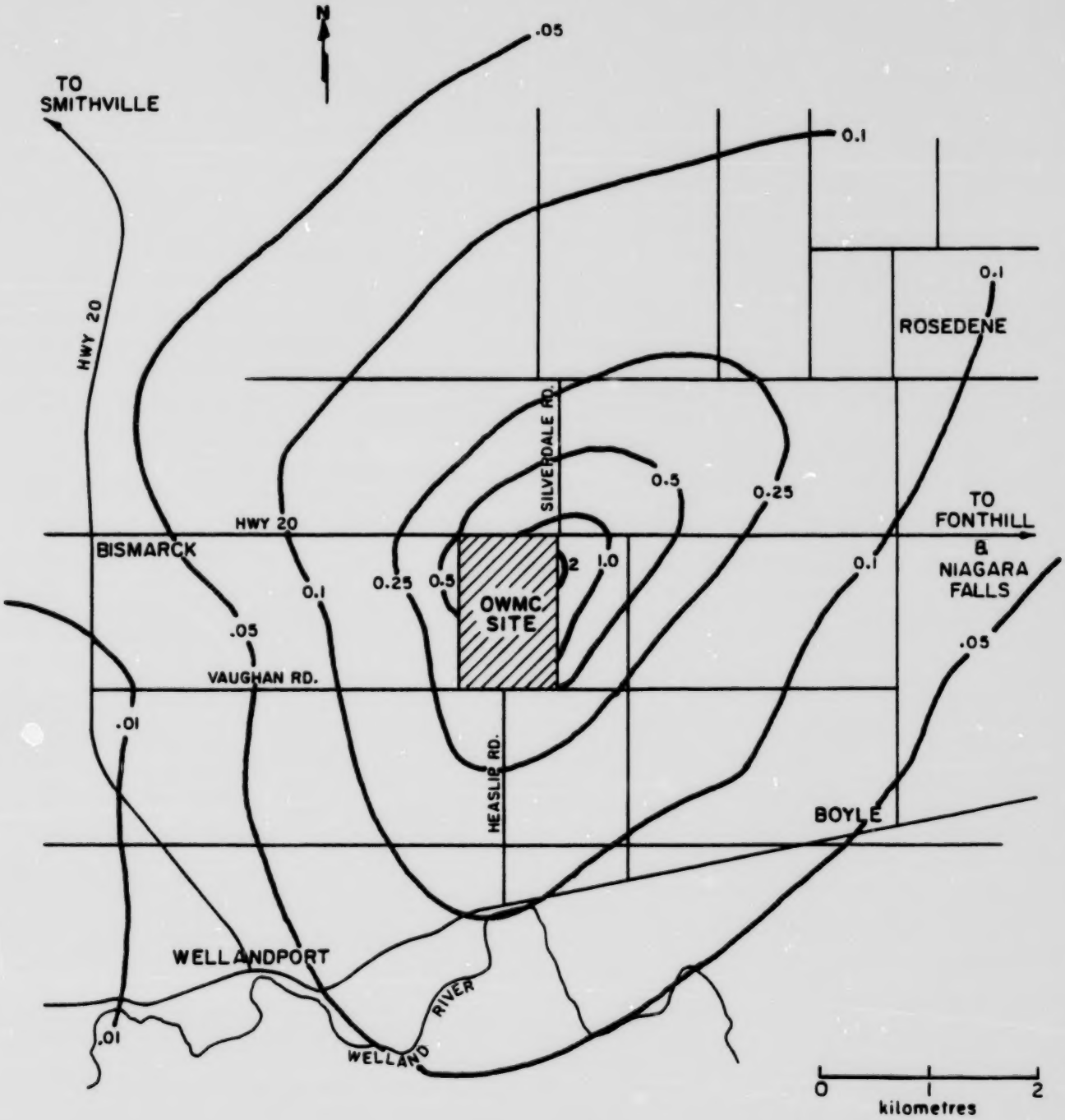


FIG. 5.17 SUMMER AVERAGE GROUND LEVEL CONCENTRATIONS ($\mu g/m^3/g/s$)
PHYSICAL / CHEMICAL TREATMENT PLANT - FUGITIVE EMISSIONS

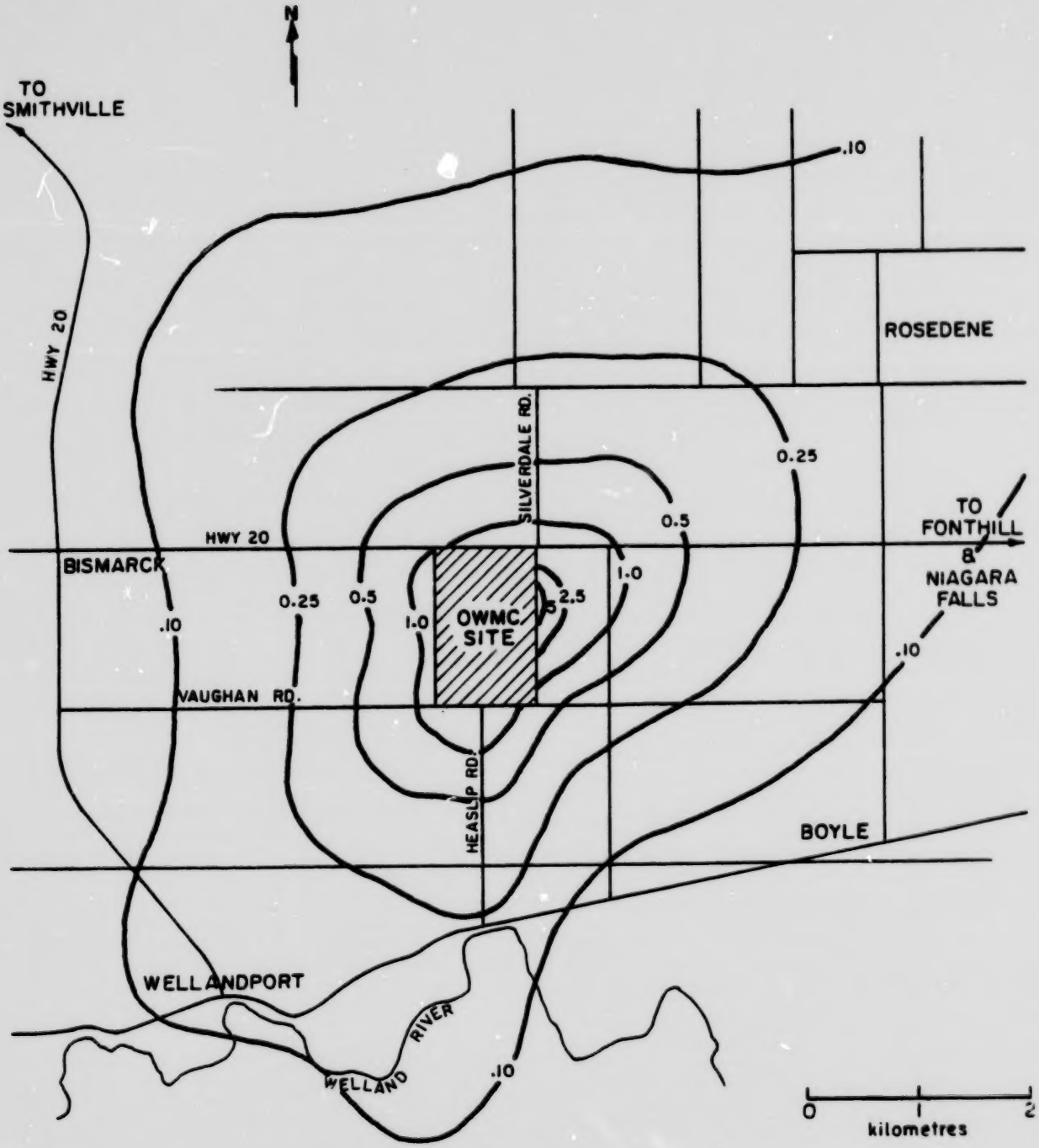


FIG. 5.18 ANNUAL AVERAGE GROUND LEVEL CONCENTRATIONS ($\mu g/m^3/g/s$)
INCINERATOR - FUGITIVE EMISSIONS

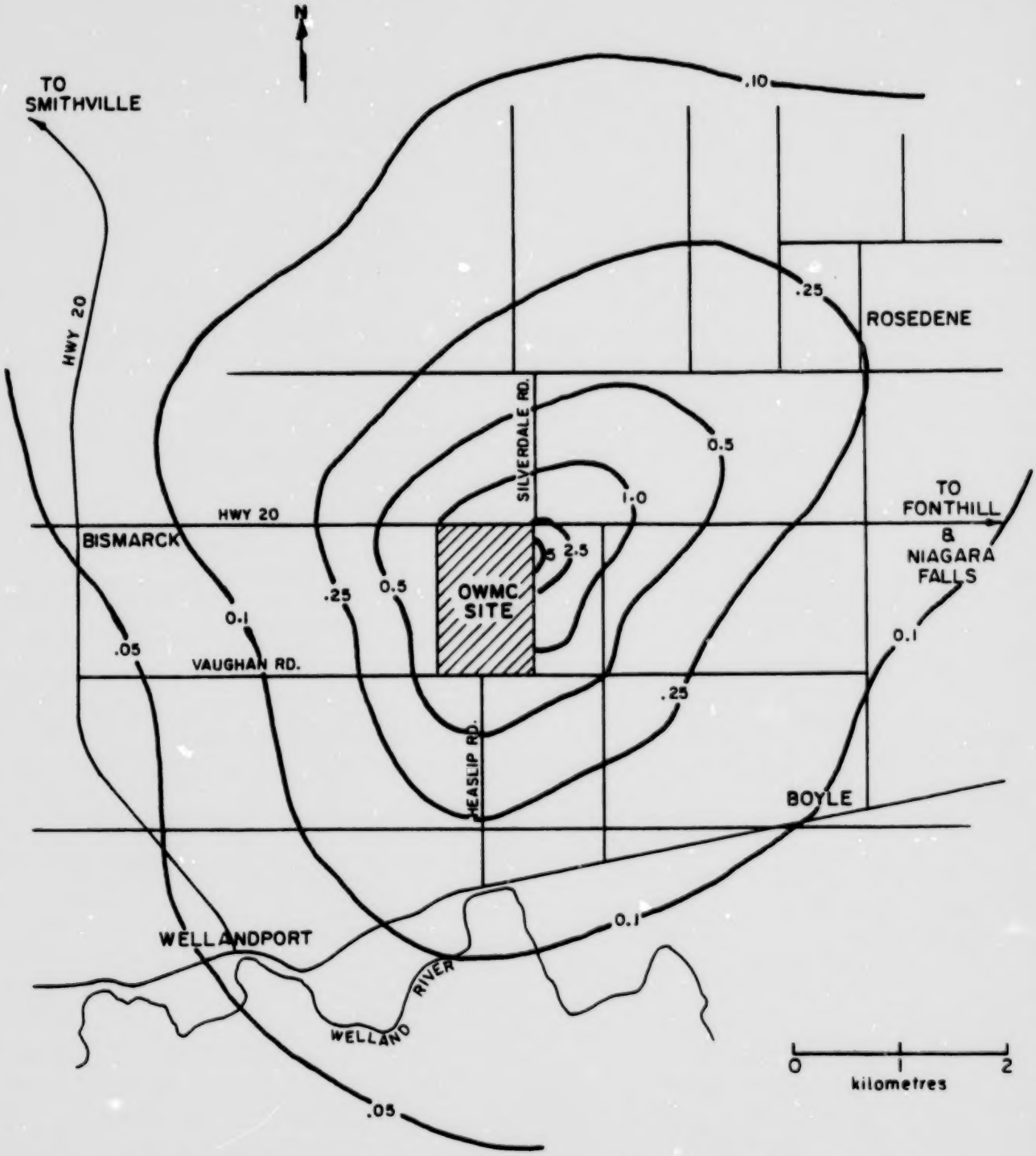


FIG. 5.19 SUMMER AVERAGE GROUND LEVEL CONCENTRATIONS ($\mu g/m^3/g/s$)
INCINERATOR - FUGITIVE EMISSIONS

TABLE 5.9

Effect of Vehicle Emissions on
Air Quality Along Access Roads - Average Conditions

Contaminant	Distance from Highway 20 (m)	Time Period	Concentrations ($\mu g/m^3$) Expected Levels in in 1995 (Without Facility)	Predicted Levels With OWMC Facility	Percentage Increase
TSP	100	24-hr	8.2	9.3	
(Re-entrained)	200		4.6	5.2	13
	500		2.2	2.4	
CO (Exhaust)	100	8-hr	5.9	6.6	
	200		3.3	3.7	13
	500		1.5	1.7	
NO_x (Exhaust)	100	1-hr	4.2	4.9	
	200		2.3	2.8	20
	500		1.1	1.3	
	100	24-hr	1.5	1.8	
	200		0.8	1.0	20
	500		0.4	0.5	
HC (Exhaust)	100	24-hr	0.5	0.6	
	200		0.3	0.3	25
	500		0.1	0.2	

TABLE 5.10

Effect of Vehicle Emissions on
Air Quality Along Access Roads - Worst Case-Conditions

Contaminant	Distance from Highway 20 (m)	Time Period	Concentrations ($\mu g/m^3$) Expected Levels in in 1995 (Without Facility)	Predicted Levels With OWMC Facility	Percentage Increase
TSP	100	24-hr	102	140	
(Re-entrained)	200		62	84	35
	500		30	41	
CO (Exhaust)	100	8-hr	70.0	96.4	
	200		42.9	59.0	38
	500		20.9	28.8	
NO_x (Exhaust)	100	1-hr	63.1	78.9	
	200		38.7	48.3	25
	500		18.9	23.6	
	100	24-hr	22.7	28.4	
	200		13.9	17.4	25
	500		6.8	8.5	
HC (Exhaust)	100	24-hr	6.9	9.1	
	200		4.2	5.6	33
	500		2.1	2.7	

Class F, with a 1 m/s wind (worst-case). In this assessment, average vehicle emissions have been combined with the commonly occurring dispersion scenario, and maximum emissions, based on maximum hourly traffic movements, are used in conjunction with worst-case dispersion conditions (see Appendix J). The short-term dispersion modelling produced 1-hour average concentrations. These values were extrapolated to 8-hour and 24-hour averages for the purposes of comparison to the Ontario air quality criteria (see Table 2.1).

Particulate levels, attributable to re-entrained road dust, are expected to increase 13 percent due to OWMC operations, under average conditions, and 35 percent under worst-case conditions. Total maximum predicted TSP levels under average conditions are well below 120 $\mu g/m^3$, which is the 24-hour criterion, but are slightly above the criterion in the worst case scenario. These concentrations are calculated at a distance of 100 m from the road. As shown in the tables, levels decrease with downwind distance and are all less than 120 $\mu g/m^3$ at distances of 200 m or more from the road.

CO emissions from vehicle exhaust are expected to increase concentrations by 13 percent and 38 percent for the average and worst-case situations, respectively. The 8-hour criterion for CO of 15 700 $\mu g/m^3$ is not exceeded in either case. NO_x concentrations are expected to increase by 20 percent in the worst case situation. These concentrations were compared to the 24-hour criterion (200 $\mu g/m^3$) and 1-hour criterion (400 $\mu g/m^3$) for NO_2. Both levels were predicted to be well below the criteria. There is no applicable criterion for hydrocarbons.

5.3.2.2 Incinerator Stack

Average and short-term peak emissions of a number of potential contaminants expected to be emitted from the OWMC incinerator stack were used to calculate maximum 1/2-hour point-of-impingement concentrations,

using the calculations prescribed in Regulation 308. The results are presented in Table 5.11. As well, standards or guidelines for each contaminant are listed. The maximum concentrations for the average emission case, and the short-term peak emission case, are presented as percentages of the allowable levels.

The list of contaminants which originated from the existing OWMC waste data base (Environ, 1987) includes some groups of compounds, rather than specific compounds (for example, alcohols). For the purpose of this analysis, it has generally been assumed that the group is represented by the compound within the group with the most stringent standard or guideline. In some cases, the most stringently regulated compound has not been used, since further investigation of the waste data base indicated the absence of the compound in current waste streams. Considering average emissions, the vast majority of contaminants are less than 0.001 percent of their allowable level. Notable exceptions are beryllium (at 19.3 percent) and arsenic and vanadium (both at 2.9 percent). It should be noted that the average emission rate for beryllium was provided by the incinerator supplier, while the short-term peak emission rate (much lower) was derived from the literature. The available literature suggests that the actual average emission rate will be much lower than indicated by the supplier. Even under the short-term worst case scenario, the predicted concentrations are all 9 percent or less of the allowable levels, with the majority less than 0.1 percent. Standards and guidelines do not presently exist for a number of the contaminants identified in Table 5.11.

5.3.2.3 Physical/Chemical Treatment Plant

Fugitive Emissions

Short-term peak fugitive organic emissions from the physical/chemical treatment plant (from Table 5.4) were applied to the Regulation 308

TABLE 5.11: Maximum Predicted Concentrations due to Incinerator Stack Emissions with Comparison to Standards and Guidelines

Contaminant	Standard or Guideline (ug/cu.m)	AVERAGE EMISSIONS Maximum Concentration (ug/cu.m)	AVERAGE EMISSIONS Max. Conc. as % of Allowable	SHORT-TERM PEAK EMISSIONS Maximum Concentration (ug/cu.m)	SHORT-TERM PEAK EMISSIONS Max. Conc. as % of Allowable
RESIDUAL ORGANICS:					
Acetates	100 (G)(1)	0.0009	0.001	0.5426	0.543
Acetone	48000 (S)	0.0003	0.000	0.2692	0.001
Acrylonitrile	300 (TS)	0.0000	0.000	0.0254	0.008
Alcohols	19000 (G)(2)	0.0000	0.000	0.0712	0.000
Aldehydes	42 (PG)(3)	0.0000	0.000	0.0121	0.029
Amines	25 (S)(4)	0.0000	0.000	0.0004	0.002
Anhydrides	100 (S)(5)	0.0001	0.000	0.1809	0.181
Benzene	10000 (S)	0.0000	0.000	0.0402	0.000
Benzothiazoles	200 (PG)	0.0000	0.000	0.0181	0.009
Benzo(a)anthracene		0.0000		0.0004	
Benzo(a)pyrene	0.0033 (PG)	0.0000	0.006	0.0002	7.400
Butadiene		0.0000		0.0003	
Carbon tetrachloride	20000 (S)	0.0000	0.000	0.3618	0.002
Chlorinated benzenes	100 (G)(6)	0.0000	0.000	0.0009	0.001
Chlorinated ethylenes	1200 (PG)(7)	0.0004	0.000	0.5969	0.050
Chloroform	1500 (G)	0.0000	0.000	0.2330	0.016
Cresols	230 (S)	0.0000	0.000	0.0814	0.035
Ethylene glycol		0.0012		0.4222	
Ethylene oxide	15 (PG)	0.0000	0.000	0.0003	0.002
Formaldehyde	65 (S)	0.0000	0.000	0.0090	0.014
Freons	1500000 (G)(8)	0.0001	0.000	0.5969	0.000
Glycerine		0.0000		0.0936	
Hexane	35000 (G)	0.0002	0.000	0.0873	0.000
Hydrazine		0.0000		0.0227	
Isopropyl alcohol	24000 (G)	0.0001	0.000	0.2503	0.001
Ketones	470 (PG)(9)	0.0003	0.000	0.4522	0.096
Methyl ethyl ketone	31000 (S)	0.0003	0.000	0.2248	0.001
Methyl isobutyl ketone	1200 (G)	0.0003	0.000	0.5728	0.048
Methylene chloride	100000 (S)	0.0003	0.000	0.5788	0.001
Naphthalene		0.0000		0.1048	
PCB	0.45 (G)	0.0000	0.000	0.0007	0.153
Perchloroethylene	10000 (G)	0.0009	0.000	0.4825	0.005
Petroleum distillate		0.0017		0.5969	
Phenol	100 (S)	0.0001	0.000	0.2464	0.246
Pyridine	60 (PG)	0.0000	0.000	0.0258	0.043
Styrene	400 (S)	0.0000	0.000	0.0704	0.018
Tetraethyl lead		0.0000		0.0050	
Toluene	2000 (S)	0.0008	0.000	0.1970	0.010
Trichloroethane		0.0008		0.5969	
Trichloroethylene	85000 (S)	0.0001	0.000	0.5969	0.001
Trichlorotrifluoroethane	2400000 (S)	0.0008	0.000	0.5969	0.000
Xylene	2300 (S)	0.0006	0.000	0.1947	0.008
ACID GASES:					
Hydrogen chloride	100 (S)	0.4343	0.434	2.2521	2.252
Hydrogen fluoride	4.3 (S)(10)	0.0290	0.673	0.1287	2.993
Nitrogen oxides	500 (S)(11)	5.7912	1.158	32.1733	6.435
Sulphur dioxide	830 (S)	4.3434	0.523	11.2607	1.357

TABLE 5.11 (contd.): Maximum Predicted Concentrations Due to Incinerator Stack Emissions with Comparison to Standards and Guidelines

Contaminant	Standard or Guideline (ug/cu.m)	AVERAGE EMISSIONS Maximum Concentration (ug/cu.m)	AVERAGE EMISSIONS Max. Conc. as % of Allowable	SHORT-TERM PEAK EMISSIONS Maximum Concentration (ug/cu.m)	SHORT-TERM PEAK EMISSIONS Max. Conc. as % of Allowable
METALS:					
Antimony	75 (S)	0.1448	0.193	0.4504	0.601
Arsenic	1 (PG)	0.0290	2.896	0.0901	9.009
Beryllium	0.03 (S)	0.0058	19.304	0.0000	0.004
Cadmium	5 (S)	0.0058	0.116	0.0193	0.386
Chromium	5 (PG)(12)	0.0290	0.579	0.0901	1.802
Cobalt		0.0290		0.0901	
Copper	100 (S)	0.1448	0.145	0.4504	0.450
Iron	10 (S)	0.0261	0.261	0.0322	0.322
Lead	10 (S)	0.1448	1.448	0.4504	4.504
Manganese	100 (S)	0.1448	0.145	0.4504	0.450
Mercury	5 (S)	0.0058	0.116	0.0193	0.386
Nickel	5 (G)	0.0290	0.579	0.0901	1.802
Selenium	20 (S)(13)	0.0290	0.145	0.0901	0.450
Tellurium	30 (S)	0.0290	0.097	0.0901	0.300
Thallium		0.0058		0.0193	
Vanadium	5 (S)	0.1448	2.896	0.4504	9.009
Zinc	100 (S)	0.1448	0.145	0.2252	0.225
PIC's (not included with residuals):					
Carbon disulphide	330 (S)	0.0009	0.000	0.0010	0.000
Ethyl benzene	4000 (S)	0.0000	0.000	0.0000	0.000
Methyl bromide	4000 (G)	0.0000	0.000	0.0000	0.000
Methyl chloride	20000 (G)	0.0042	0.000	0.0090	0.000
PCDD	0.00045 (PG)	0.0000	0.026	0.0000	0.293
PCDD + PCDF	0.00045 (PG)(14)	0.0000	0.154	0.0000	0.307
PCDF		0.0000		0.0000	
Pentachlorophenol	60 (G)	0.0002	0.000	0.0002	0.000
Vinyl chloride	560 (G)	0.0002	0.000	0.0005	0.000
MISCELLANEOUS					
Carbon monoxide	6000 (S)	2.0269	0.034	9.0085	0.150
Cyanide	1150 (S)(15)	0.1448	0.013	0.4504	0.039
Particulate	100 (S)	0.4343	0.434	2.2521	2.252
Total hydrocarbons		0.4343		1.8017	

Notes:

(S) standard (Regulation 308)
(TS) tentative standard
(G) guideline
(PG) provisional guideline

(1) as cellosolve acetate
(2) as ethyl alcohol
(3) as glutaraldehyde
(4) as monoethyl amine
(5) as phthalic anhydride
(6) as 1,2,4 trichlorobenzene
(7) as ethylene dichloride
(8) as Freon 12
(9) as diisobutyl ketone
(10) gaseous, April 1 - October 31
(11) as nitrogen dioxide
(12) di, tri and hexavalent forms

(13) except hydrogen telluride
(14) calculated as PCDD + PCDF/50
(15) as hydrogen cyanide

dispersion model to derive 1/2-hour maximum point-of-impingement concentrations. These are presented in Table 5.12. When these concentrations are compared to standards and guidelines, all but two of the identified contaminants are below 2 percent of the allowable levels. The only exceptions are amines (4.3 percent), and chlorinated ethylenes (15.5 percent).

As discussed previously, in the case of incinerator stack emissions, a limitation of the analysis is the use of the existing OWMC waste data base, in that some compound groups rather than specific compounds are included. For the purposes of comparing concentrations to existing standards and guidelines, compound groups were generally represented by compounds within the group having the most stringent allowable concentrations. Some compounds may not turn out to be present in current waste streams. As well, the fugitive emission factors used in this analysis may be overestimated for certain compounds.

Evaporator Stack Emissions

The maximum 1/2-hour point-of-impingement concentrations were calculated according to Regulation 308 for the evaporator stack in the two venting modes (15 t/h and 36 t/h), and the results compared to standards and guidelines. Estimates of the percentages of the allowable concentrations are presented in Table 5.13. Most of the concentrations are well below 0.1 percent of the allowable level, even for the 36 t/h case, with the highest value of 0.15 percent indicated for formaldehyde.

Evaporator Stack - Plume Visibility

This section is concerned with the impacts of the steam plume which would be emitted from an effluent evaporator attached to the OWMC physical/chemical treatment plant. The steam would be released through a stack and would then mix vigorously with ambient air and undergo rapid cooling. In so doing, condensation would occur, giving rise to a visible

TABLE 5.12: Maximum Predicted Concentrations Due to Physical/Chemical Treatment Plant - Fugitive Emissions with Comparison to Standards and Guidelines

Contaminant	Standard or Guideline (ug/cu.m)	SHORT-TERM PEAK EMISSIONS Maximum Concentration (ug/cu.m)	Max. Conc. as % of Allowable
Acetates	100 (G)(1)	0.8355	0.836
Acetone	48000 (S)	0.0000	0.000
Acrylonitrile	300 (TS)	5.5822	1.861
Alcohols	19000 (G)(2)	8.9113	0.047
Aldehydes	42 (PG)(3)	0.0123	0.029
Amines	25 (S)(4)	1.0702	4.281
Anhydrides	100 (S)(5)	0.0000	0.000
Benzene	10000 (S)	0.0178	0.000
Benzothiazoles	200 (PG)	0.0000	0.000
Benzo(a)anthracene		0.0000	
Benzo(a)pyrene	0.0033 (PG)	0.0000	0.000
Butadiene		0.6596	
Carbon tetrachloride	20000 (S)	0.0000	0.000
Chlorinated benzenes	100 (G)(6)	0.0000	0.000
Chlorinated ethylenes	1200 (PG)(7)	185.6246	15.469
Chloroform	1500 (G)	0.0000	0.000
Cresols	230 (S)	0.0000	0.000
Ethylene glycol		0.0000	
Ethylene oxide	15 (PG)	0.0000	0.000
Formaldehyde	65 (S)	0.3612	0.556
Freons	1500000 (G)(8)	1.8740	0.000
Glycerine		0.0000	
Hexane	35000 (G)	0.0000	0.000
Hydrazine		0.0000	
Isopropyl alcohol	24000 (G)	11.1936	0.047
Ketones	470 (PG)(9)	0.0000	0.000
Methyl ethyl ketone	31000 (S)	0.0000	0.000
Methyl isobutyl ketone	1200 (G)	0.0000	0.000
Methylene chloride	100000 (S)	0.0000	0.000
Naphthalene		0.0001	
PCB	0.45 (G)	0.0000	0.000
Perchloroethylene	10000 (G)	9.6243	0.096
Petroleum distillate		2.1608	
Phenol	100 (S)	0.1909	0.191
Pyridine	60 (PG)	0.0000	0.000
Styrene	400 (S)	1.1668	0.292
Tetraethyl lead		0.0000	
Toluene	2000 (S)	10.8245	0.541
Trichloroethane		0.2200	
Trichloroethylene	85000 (S)	0.0177	0.000
Trichlorotrifluoroethane	2400000 (S)	0.2714	0.000
Xylene	2300 (S)	3.0940	0.135
Ammonia	3600 (S)	46.7600	1.299
Hydrogen cyanide	1150 (S)	0.0001	0.000
Hydrogen sulphide	30 (S)	0.0000	0.000

Notes:
(1) as cellosolve acetate
(2) as ethyl alcohol
(3) as glutaraldehyde
(4) as monomethyl amine
(5) as phthalic anhydride
(6) as 1,2,4 trichlorobenzene
(7) as ethylene dichloride
(8) as Freon 12
(9) as diisobutyl ketone

TABLE 5.13: Maximum Predicted Concentrations Due to Evaporator Stack with Comparison to Standards and Guidelines

Contaminant	Standard or Guideline (ug/cu.m)	VENTING MODE - 15 t/h Maximum Concentration (ug/cu.m)	VENTING MODE - 15 t/h Max. Conc. as % of Allowable	VENTING MODE - 36 t/h Maximum Concentration (ug/cu.m)	VENTING MODE - 36 t/h Max. Conc. as % of Allowable
Acenephthene		0.0040		0.0096	
Acrylonitrile	300 (TS)	0.0399	0.013	0.0958	0.032
Aldrin		0.0000		0.0000	
Benzene	10000 (S)	0.0050	0.000	0.0121	0.000
Benzo (k) fluoranthene		0.0001		0.0002	
Bis (2-chloroethyl) ether		0.0096		0.0230	
Butadiene		0.0399		0.0958	
Butyl benzyl phthalate		0.0006		0.0014	
Carbon tetrachloride	20000 (S)	0.0020	0.000	0.0048	0.000
Chloroform	1500 (G)	0.0020	0.000	0.0048	0.000
Chlorophenol	60 (G)(1)	0.0160	0.027	0.0384	0.064
Formaldehyde	65 (S)	0.0399	0.061	0.0958	0.147
Hexachlorobenzene		0.0001		0.0002	
Lindane	15 (PG)	0.0000	0.000	0.0000	0.000
Methylene chloride	100000 (S)	0.0321	0.000	0.0770	0.000
PCB	0.45 (G)	0.0000	0.001	0.0000	0.003
Perchloroethylene	10000 (G)	0.0160	0.000	0.0384	0.000
Phenol	100 (S)	0.0016	0.002	0.0038	0.004
Styrene	400 (S)	0.0080	0.002	0.0192	0.005
Toluene	2000 (S)	0.0160	0.001	0.0384	0.002
Trichloroethylene	85000 (S)	0.0801	0.000	0.1922	0.000
Trichlorophenol, 2,4,6		0.0003		0.0008	
Xylene	2300 (S)	0.0080	0.000	0.0192	0.001
Arsenic	1 (PG)	0.0000	0.000	0.0000	0.000
Beryllium	0.03 (S)	0.0000	0.000	0.0000	0.000
Cadmium	5 (S)	0.0000	0.000	0.0000	0.000
Chromium	5 (PG)(2)	0.0000	0.000	0.0000	0.000
Mercury	5 (S)	0.0000	0.000	0.0000	0.000
Nickel	5 (S)	0.0000	0.000	0.0000	0.000

Notes:

(S) standard (Regulation 308)
(TS) tentative standard
(G) guideline
(PG) provisional guideline

(1) as pentachlorophenol
(2) di, tri and hexavalent forms

plume of water droplets. As further mixing with ambient air occurs, the plume would become deeper and wider but water droplets would gradually re-evaporate. The rate of this re-evaporation would depend on the ambient temperature and humidity conditions (the rate would be higher in warm weather and low humidity conditions) and the degree of turbulent mixing with the environment, which is itself a function of wind speed and atmospheric stability (the re-evaporation rate would be enhanced by higher wind speeds and atmospheric instability). In the condensed phase, the droplets would be visible as an elevated white plume extending from a point a short distance from the top of the stack downwind until, due to re-evaporation, it gradually disappears. Apart from the potential problem of aesthetics, the condensed region of the plume may become deep enough under some conditions to impinge on other plant structures and on the ground at some distance from the point of release. This may result in impaired visibility and, in cold weather, icing of roads and structures. Under some conditions water droplets may coalesce and fall out of the plume, resulting in icing conditions underneath the plume. A further concern relates to contaminants which may be present in the feed water and be released to the atmosphere with the steam (see Section 5.2.3). These would be dispersed with the plume and, thus, may become potential pollutants in ambient air at ground level downwind from the stack. The contaminants may also be deposited to ground underneath the plume, having been "rained out" with the coalesced water droplets.

The following summarizes the assessment of these potential impacts of the evaporation option. Specifically, it covers two areas of concern:

- visibility of the steam plume which would emanate from the evaporator stack, and

- fogging and icing on plant structures and at ground level.

Plume Visibility

The methodology used to predict visible plume lengths is summarized in Appendix P. Tables 5.14 and 5.15 give the probabilities of exceeding defined visible plume lengths during the months of January, April, July and October, representing the four seasons.

Table 5.14 shows results for a steam emission rate of 25.9 t/h. This is the maximum design capacity for storm water treatment (Monenco, 1987). Assuming this occurs once a year and requires 18 days of continuous operation in this mode, the number of hours when plume lengths exceed the defined values can be determined by multiplying the probabilities by the expected number of operating hours per year (18 x 24 = 432 hours). Thus, assuming the storm event occurs in the spring (April), the expected number of hours per year when the plume length exceeds 500 m is 0.14 x 432 = 60.5 hours.

Table 5.15 gives results for a steam emission rate of 8.63 t/h. This is considered to be the most likely normal operating mode when the condenser is by-passed (Monenco, 1987). At a plant capacity of 150 000 t/a, and assuming 4 600 t/a of water to be evaporated, this scenario would apply for 535 hours per year. In this case, the number of hours when the visible plume is greater than 500 m long is 0.35 x 535 ÷ 4 = 46.8 in winter (January), 0.047 x 535 ÷ 4 = 6.3 in spring (April), 0.024 x 535 ÷ 4 = 3.2 in summer (July) and 0.10 x 535 ÷ 13.4 = 4.0 in autumn (October). Note that this assumes an equal number of hours of operation in the four seasons. As well, all the above results assume random hours of operation (i.e., no attempt to avoid the worst plume conditions by holding up the evaporator feed even though this will probably be practiced in actual operation). It is noted that 25.9 t/h venting rate will occur when the evaporator is occasionally operated at full venting mode, to dispose of surplus water when the surface water pond is contaminated. During typical operation, steam venting is expected to be around 2 t/h. However, if intermittent rather than continuous venting is elected, the intermittent venting rate could be as high as 8.63 t/h.

TABLE 5.14

Evaporator Stack -
Visible Plume Length Probabilities (25.9 t/a Scenario)

Visible Plume Length (m)	Probability of Exceeding Visible Plume Length			
	January (winter)	April (spring)	July (summer)	October (autumn)
100	1.0	0.99	0.76	1.0
200	1.0	0.79	0.28	0.85
500	0.90	0.14	0.060	0.19
1000	0.35	0.043	0.014	0.099
2000	0.13	0.0071	0	0.015
5000	0.038	0.00095	0	0.0043

TABLE 5.15

Evaporator Stack -
Visible Plume Length Probabilities (8.63 t/a Scenario)

Visible Plume Length (m)	Probability of Exceeding Visible Plume Length			
	January (winter)	April (spring)	July (summer)	October (autumn)
100	1.0	0.81	0.37	0.91
200	1.0	0.23	0.099	0.33
500	0.35	0.047	0.024	0.099
1000	0.090	0.0064	0	0.013
2000	0.042	0.00095	0	0.0043
5000	0.0049	0	0	0

Fogging and Icing

The potential for fogging and icing at ground level was assessed using the same methodology employed to predict visible plume lengths. This analysis showed that fogging would occur only with extremely unstable atmospheres and extremely cold temperatures. Since this combination is unlikely in practice (the most unstable conditions normally occur in summer) and, in any case, any impaired visibility under these conditions would be limited to OWMC property and would be highly intermittent, it was concluded that there would be no significant potential for ground level fogging and icing. However, to ensure the validity of this conclusion, and to avoid icing of other plant structures, the stack should be high enough to avoid impingement on other plant structures and interference with the aerodynamic wakes. Thus, assuming the tallest nearby building is approximately 25 m high, a stack height of 40 m or more may be required. The present reference design includes a 45 m stack.

This assessment has indicated that the stack plume from the evaporator would not result in any significant fogging or icing effects. However, a visible plume of condensate would be formed under almost all conditions. Typically, this would be several hundreds of metres long and, under extreme temperature, humidity and dispersion conditions, could be two kilometres or more in length.

5.3.2.4 Fugitive Dust

As discussed in earlier sections, particulates are expected to be the major pollutant to be emitted from the landfill operations. The predicted short-term (1-hour) concentrations of suspended particulate matter resulting from the landfill operations are presented in Figure 5.20. Other fugitive sources of particulate matter during operations are expected to be insignificant in comparison to the landfill and were not included in this analysis. The maximum concentration

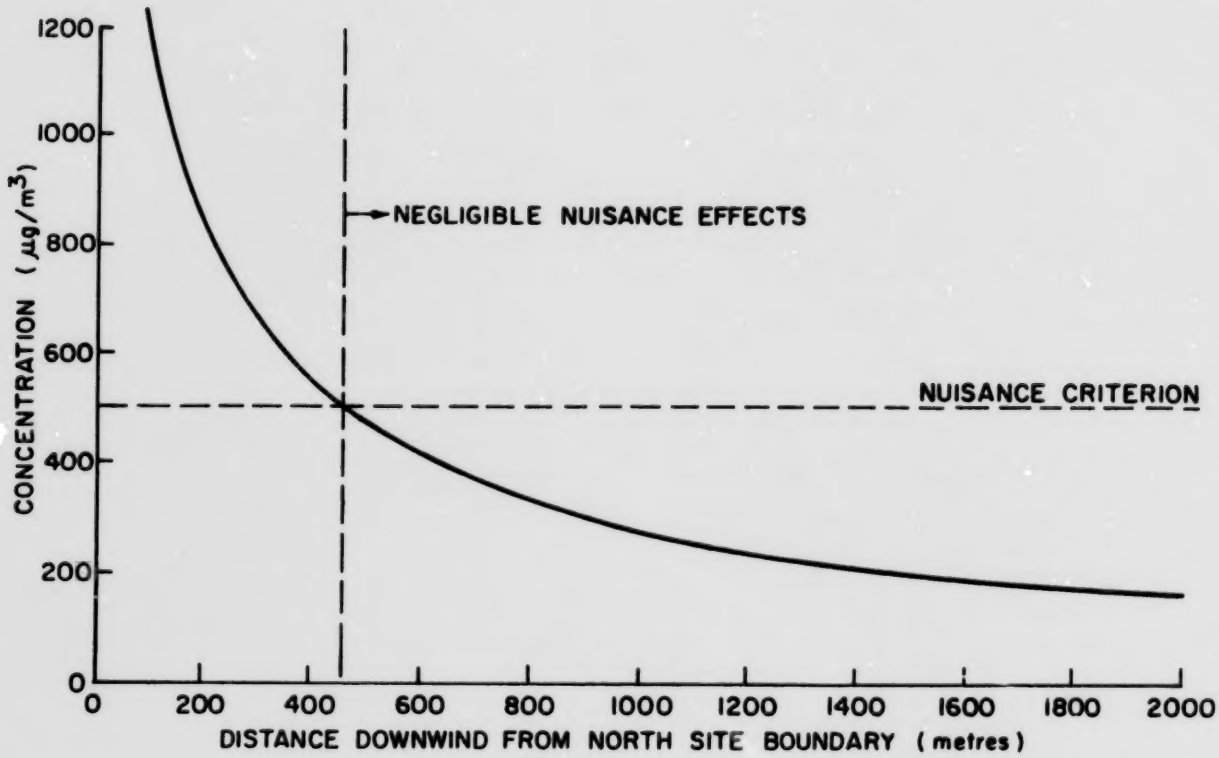


FIG. 5.20 SHORT-TERM (1-HOUR) SUSPENDED DUST CONCENTRATIONS DUE TO LANDFILL OPERATIONS.

expected at an existing receptor is predicted to be at the north site boundary, with concentrations from simultaneously excavation and filling operations approaching levels near 2000 $\mu g/m^3$. These "worst-case" hourly concentrations fall off rapidly with distance, with the combined levels from the operations predicted to be less than 500 $\mu g/m^3$ at receptors 500 m downwind of the north boundary, approximately 300 $\mu g/m^3$ at receptors 1000 m downwind; and less than 200 $\mu g/m^3$ at a distance of 2000 m.

Figures 5.21 and 5.22 illustrate the predicted annual and summer concentrations of suspended particulate attributable to the landfill. The maximum concentrations are predicted to occur to the north and northeast of the landfill during the first year of operation, with peak levels estimated to be near 15 and 30 $\mu g/m^3$ for the annual and summer periods, respectively. The influence of the prevailing southwest winds is evident in these figures, resulting in higher concentrations to the north and northeast of the site.

Levels of suspended particulates at rural sites in the Niagara Peninsula have been measured by the Ministry of the Environment in the range of 26 to 59 $\mu g/m^3$ (see Appendix H). An annual geometric mean of 29 $\mu g/m^3$ and a summer geometric mean of 35 $\mu g/m^3$ were measured during the baseline studies at the OWMC site. The particulate levels predicted by the model would indicate that annual average levels at receptors adjacent to the site along Highway 20 would increase by approximately 50 percent during the period of landfilling at the northwest corner of the site, and almost double over the summer period. Beyond approximately 500 m from the OWMC site boundaries, the contribution from the landfill facility is predicted to be minimal.

The Ontario ambient air quality criterion for total suspended particulate is 60 $\mu g/m^3$ (annual average). If the existing annual mean level of 29 $\mu g/m^3$ is added to the predicted levels, the resulting concentrations would still be within the annual criterion.

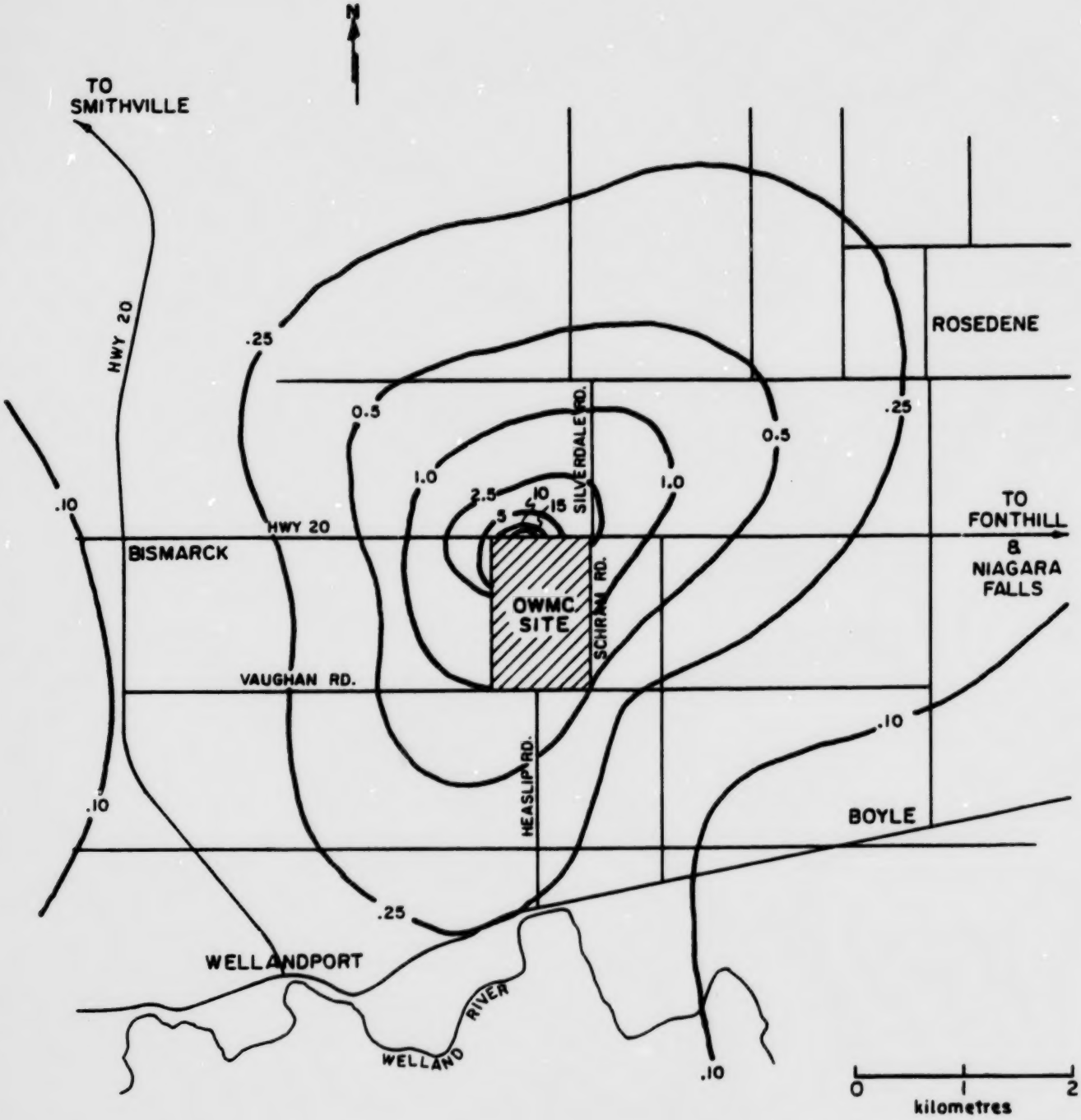


FIG. 5.21 ANNUAL AVERAGE GROUND LEVEL CONCENTRATIONS ($\mu g/m^3$) OF SUSPENDED PARTICULATE MATTER - LANDFILL OPERATION

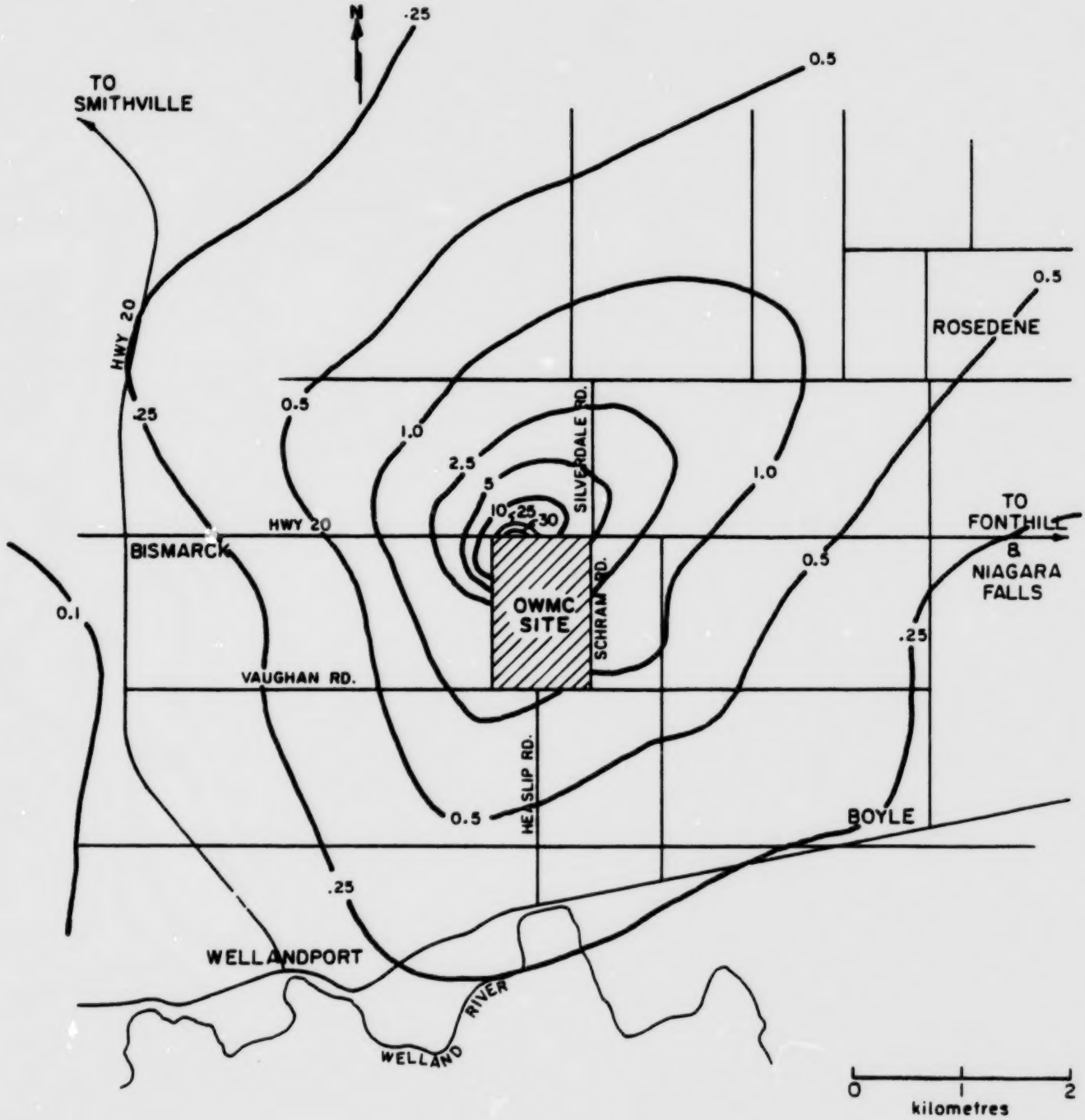


FIG. 5.22 SUMMER AVERAGE GROUND LEVEL CONCENTRATIONS ($\mu g/m^3$) OF SUSPENDED PARTICULATE MATTER - LANDFILL OPERATION

The short-term 1/2-hour point-of-impingement standard for total suspended particulates is 100 $\mu g/m^3$. However, this level is commonly exceeded, even in rural areas, and does not necessarily represent a nuisance level. Instead, a criterion for dust nuisance due to soiling of surfaces was developed based on the Ontario dustfall standard of 8 000 $\mu g/m^2$ (1/2-hour average). This criterion is equivalent to approximately 500 $\mu g/m^3$ of suspended particulate (see Section 4.3.4). From Figure 5.20, the level of 500 $\mu g/m^3$ is not exceeded beyond a distance of approximately 460 m from the site boundary.

It is emphasized that the prediction of dust nuisance impacts cannot be made precisely due to the large number of assumptions necessary in the analysis and the uncertain effectiveness of dust suppression techniques. In recognition of this, the above analysis was carried out on a reasonable worst-case basis. However, even under the most adverse conditions, the results show that any impacts would be limited to the immediate vicinity of the OWMC site. Such episodes as do occur are expected to be infrequent and of short duration.

5.3.2.5 Fugitive Emissions - Organic Unloading/Storage Area

Table 5.16 summarizes the results of the comparison of predicted maximum 1/2-hour point-of-impingement concentrations (calculated according to Regulation 308) using the emission rates from Table 5.3 for the organic unloading and storage area of the facility. Considering average emissions, all concentrations are 1 percent or less of allowable (the majority are below 0.1 percent). The comparison of predicted concentrations based on short-term peak emissions with allowable levels shows no exceedances of standards and guidelines. All contaminants are less than 5 percent of allowable (the majority are less than 1 percent of allowable). Exceptions are amines (11.6 percent, represented as monomethyl amine) and chlorinated ethylenes (29.9 percent, represented as ethylene dichloride). However, as with volatile organic emissions from the physical/chemical treatment plant, the conservative nature of the calculations underlying these results is noted.

TABLE 5.16: Maximum Predicted Concentrations Due to Organic Unloading/Storage Area - Fugitive Emissions with Comparison to Standards and Guidelines

Contaminant	Standard or Guideline (ug/cu.m)	AVERAGE EMISSIONS Maximum Concentration (ug/cu.m)	AVERAGE EMISSIONS Max. Conc. as % of Allowable	SHORT TERM PEAK EMISSIONS Maximum Concentration (ug/cu.m)	SHORT TERM PEAK EMISSIONS Max. Conc. as % of Allowable
Acetates	100 (G)(1)	0.2965	0.296	1.7706	1.771
Acetone	48000 (S)	9.4064	0.020	114.8726	0.239
Acrylonitrile	300 (TS)	0.0411	0.014	10.5757	3.525
Alcohols	19000 (G)(2)	0.1250	0.001	16.3378	0.086
Aldehydes	42 (PG)(3)	0.0000	0.000	0.0229	0.054
Amines	25 (S)(4)	0.1204	0.482	2.9037	11.615
Anhydrides	100 (S)(5)	0.0064	0.006	0.0093	0.009
Benzene	10000 (S)	0.2127	0.002	18.9847	0.190
Benzothiazoles	200 (PG)	0.0001	0.000	0.0052	0.003
Benzo(a)anthracene		0.0000		0.0000	
Benzo(a)pyrene	0.0033 (PG)	0.0000	0.413	0.0000	0.413
Butadiene		0.0705		1.2240	
Carbon tetrachloride	20000 (S)	0.1279	0.001	80.9686	0.405
Chlorinated benzenes	100 (G)(6)	0.0005	0.000	0.0021	0.002
Chlorinated ethylenes	1200 (PG)(7)	7.2261	0.602	358.9724	29.914
Chloroform	1500 (G)	0.3645	0.024	101.2695	6.751
Cresols	230 (S)	0.0022	0.001	0.0049	0.002
Ethylene glycol		0.0874		0.1454	
Ethylene oxide	15 (PG)	0.0391	0.260	0.8273	5.516
Formaldehyde	65 (S)	0.0342	0.053	0.7285	1.121
Freons	1500000 (G)(8)	34.2223	0.002	914.9280	0.061
Glycerine		0.0005		0.0005	
Hexane	35000 (G)	1.8331	0.005	65.5481	0.187
Hydrazine		0.0000		0.7913	
Isopropyl alcohol	24000 (G)	0.1382	0.001	21.2695	0.089
Ketones	470 (PG)(9)	0.0694	0.015	1.9469	0.414
Methyl ethyl ketone	31000 (S)	2.6071	0.008	55.6887	0.180
Methyl isobutyl ketone	1200 (G)	0.4711	0.039	15.2242	1.269
Methylene chloride	100000 (S)	7.9139	0.008	296.6338	0.297
Naphthalene		0.0008		0.1247	
PCB	0.45 (G)	0.0048	1.078	0.0050	1.119
Perchloroethylene	10000 (G)	0.7991	0.008	18.5040	0.185
Petroleum distillate		0.5193		4.4080	
Phenol	100 (S)	0.0144	0.014	0.3704	0.370
Pyridine	60 (PG)	0.0251	0.042	0.1408	0.235
Styrene	400 (S)	0.0067	0.002	2.1735	0.543
Tetraethyl lead		0.0000		0.0001	
Toluene	2000 (S)	1.2921	0.065	21.1269	1.056
Trichloroethane		4.9418		105.8451	
Trichloroethylene	85000 (S)	0.2905	0.000	51.8090	0.061
Trichlorotrifluoroethane	2400000 (S)	15.9000	0.001	352.0021	0.015
Xylene	2300 (S)	0.2822	0.012	5.9393	0.258
Hydrogen cyanide	1150 (S)	0.0000	0.000	0.0006	0.000
Hydrogen sulphide	30 (S)	0.0005	0.002	0.0383	0.128

Notes: (S) standard (Regulation 308)
(TS) tentative standard
(G) guideline
(PG) provisional guideline

(1) as cellosolve acetate
(2) as ethyl alcohol
(3) as glutaraldehyde
(4) as monoethyl amine
(5) as phthalic anhydride

(6) as 1,2,4 trichlorobenzene
(7) as ethylene dichloride
(8) as Freon 12
(9) as diisobutyl ketone

5.3.3 OVERALL FACILITY EFFECT ON AIR QUALITY

The contributions from the individual sources within the OWMC facility have been assessed in terms of allowable air quality standards and guidelines. However, to put the entire facility into the proper perspective, all sources need to be considered simultaneously. The point of maximum concentration occurs at various distances and locations off-site, depending on local meteorological conditions. In most cases, the fugitive emissions from the organic storage/loading area will result in the highest concentrations of organics, while the highest dust levels can be expected to result from the landfilling operations. Since certain sources dominate and their maximum ambient concentrations occur in different places, emissions from individual facility components can be considered in isolation. However, due to their close proximity, fugitive emissions from the physical/chemical treatment plant and organic storage/unloading area sources are generally additive. On this basis, the emissions of all identified contaminants are well within air quality standards and guidelines.

In addition, Table 5.17 lists the maximum hourly, 24-hourly and annual concentrations for the relevant source(s) and compares the values to the criteria for desirable air quality listed in Regulation 296 under the Environmental Protection Act. Levels of these pollutants measured during the baseline study, representing existing levels, are included in the table to enable an assessment to be made of the overall effect of facility emissions on local air quality.

Table 5.17 indicates that the existing levels of pollutants at the site do not exceed the Regulation 296 criteria except in the cases of particulate matter (24-hour average) and ozone (1-h average). When the facility contribution is added to the existing maximum levels of all the pollutants listed, the levels are still within the desirable range, again with the exception of particulate matter (no direct emissions of ozone from the facility are predicted). In the case of particulate matter, however, the facility emissions add an amount equivalent to only 1

TABLE 5.17: Overall Evaluation of OWMC Emissions with Comparison to Desirable Air Quality Criteria

Contaminant	Criterion (ug/cu.m)	Averaging Time	Maximum Concentrations (ug/cu.m) Existing(1)	OWMC	OWMC as % of Existing	Existing as % of Criterion	OWMC + Existing as % of Criterion
Arsenic	25	24 hours	0.003	0.049	1873.66	0.01	0.21
Cadmium	2	24 hours	0.001	0.010	782.29	0.07	0.57
Carbon monoxide	36200	1 hour	10300.000 *	68.310	0.66	28.45	28.64
	15700	8 hours	1100.000 *	11.185	1.02	7.01	7.08
Fluorides (gaseous)	0.86 (2)	24 hours	0.080	0.061	76.63	9.30	16.43
Hydrogen sulphide	30	1 hour	5.600	0.782	13.97	18.67	21.27
Lead	5	24 hours	0.033	0.243	737.14	0.66	5.53
Mercury	2	24 hours	0.016	0.010	63.56	0.80	1.31
Nickel	2	24 hours	0.006	0.049	885.73	0.27	2.71
Nitrogen dioxide	400	1 hour	107.000	243.570	227.64	26.75	87.64
	200	24 hours	62.000	14.187	22.88	31.00	38.09
Ozone	165	1 hour	237.000	0.000	0.00	143.64	143.64
Sulphur dioxide	690	1 hour	277.000	85.215	30.76	40.14	52.49
	275	24 hours	72.000	6.482	9.00	26.18	28.54
	55	1 year	12.600	0.054	0.43	22.91	23.01
Suspended	120	24 hours	123.000	1.017	0.83	102.50	103.35
particulate	60	1 year	29.000	0.005	0.02	48.33	48.34
Vanadium	2	24 hours	0.005	0.243	4865.11	0.25	12.41

Notes:

(1) from site baseline monitoring (1986-87), if unavailable estimate from literature (*)
(2) lowest criteria, for period April 15 - October 15

percent of the criterion. Otherwise, the largest percentages predicted are 88 percent of the 1-hour nitrogen dioxide criterion, and 52 percent of the 1-hour sulphur dioxide criterion. However, the contribution of the OWMC facility in these two cases is only significant for NO_2. The remaining percentages range from less than 50 percent to less than 1 percent. Thus, the calculations indicate that facility emissions would not result in exceedances of the criteria for desirable ambient air quality as set out in Regulation 296. Where the existing concentration is outside the desirable range, the predicted increment due to OWMC's emissions would not add significantly to such a concentration.

5.3.4 ODOUR POTENTIAL

One of the main concerns with operating a hazardous waste management facility is the potential for handling odourous substances which, when dispersed, could still be detected at receptors off-site. From the lists of potential substances to be handled at each facility component, odour thresholds were obtained for a number of organics and inorganics, and these are listed in Appendix Q. In the development of the odour thresholds, the lowest reasonable values found in the literature were used. Furthermore, where compound groups were identified (e.g., alcohols), the most odorous compound within the group was assumed to be present. The maximum off-site concentrations of these contaminants predicted from all OWMC sources were compared to the thresholds, and the percentages of these thresholds calculated.

It should be noted that the potential for odour detection has been evaluated for each chemical compound or class individually. It is not possible to predict the net odour impact of a variety of odorants in combination. However, the use of the odour threshold for evaluating the potential odour impact of a given compound is a conservative approach. The presence of concentrations of an odorant at or slightly above the detection threshold may not produce an odour nuisance. Odorants vary considerably in qualities such as pervasiveness, i.e., the rate of change of perceived odour intensity versus concentration, and hedonic tone. The

tendency for an odour to cause a nuisance also depends on other factors such as the context in which the odour is perceived and the frequency of the occurrence of the odour.

In this analysis, the short-term (1-hour average) maximum concentration factors predicted by dispersion modelling under worst-case meteorological conditions were further multiplied by 10 to allow for momentary excursions above the 1-hour average. Such peak concentrations could result in perceptible odours.

In the case of the physical/chemical treatment plant (Table 5.18), fugitive emissions of five contaminants were predicted to exceed the odour thresholds, i.e., alcohols (assumed to be 2-butanol), amines (assumed to be monomethyl amine), chlorinated ethylenes (assumed as dichloroethylene), styrene and toluene. These exceedances apply to short-term peak emissions only. Odour information is currently lacking for a number of compounds.

For the evaporator stack, the odour evaluation indicated that only emissions of chlorophenols would exceed odour thresholds by 696 percent (36 t/h scenario) and 290 percent (15 t/h scenario) (see Table 5.19). It was assumed that the compound group was represented by 2,4,6 trichlorophenol.

Emissions from the incinerator (Table 5.20) do not show exceedances of the thresholds for any of the contaminants with the exception of cresols (131 percent of threshold for short-term peak emissions only, assuming this is m-cresol).

Table 5.21 lists the results of the odour threshold calculations for fugitive emissions from the organic unloading/storage area. Exceedances of odour thresholds are predicted for short-term peak emissions only of acetone, alcohols (as 2-butanol), amines (as monomethyl amine), chlorinated ethylenes (as dichloroethylene), Freons (as

TABLE 5.18: Physical/Chemical Treatment Plant - Fugitive Emissions - Odour Evaluation

Contaminant	Odour Threshold (ug/cu.m)	SHORT-TERM PEAK EMISSIONS Maximum Concentration (ug/cu.m)	Max. Conc. as % of Threshold
Acetates	15000 (1)	164.12	1.094
Acetone	9000	0.00	0.000
Acrylonitrile	49000	1096.50	2.238
Alcohols	380 (2)	1750.44	460.641
Aldehydes	14 (3)	2.41	17.201
Amines	28 (4)	210.21	750.752
Anhydrides	620 (5)	0.00	0.000
Benzene	16000	3.50	0.022
Benzothiazoles	470	0.00	0.000
Benzo(a)anthracene		0.00	
Benzo(a)pyrene		0.00	
Butadiene	1000	129.57	12.957
Carbon tetrachloride	660000	0.00	0.000
Chlorinated benzenes	1000 (6)	0.00	0.000
Chlorinated ethylenes	4600 (7)	36461.98	792.652
Chloroform	690000	0.00	0.000
Cresols	4.7 (8)	0.00	0.000
Ethylene glycol		0.00	
Ethylene oxide	490000	0.00	0.000
Formaldehyde	1300	70.95	5.458
Freons	30000 (9)	368.10	1.227
Glycerine		0.00	
Hexane	34000	0.00	0.000
Hydrazine		0.00	
Isopropyl alcohol	8300	2198.74	26.491
Ketones		0.00	
Methyl ethyl ketone	6200	0.00	0.000
Methyl isobutyl ketone	430	0.00	0.000
Methylene chloride	780000	0.00	0.000
Naphthalene	210	0.02	0.011
PCB		0.00	
Perchloroethylene	34000	1890.49	5.560
Petroleum distillate		424.44	
Phenol	160	37.50	23.438
Pyridine	71	0.00	0.000
Styrene	210	229.20	109.143
Tetraethyl lead		0.00	
Toluene	670	2126.24	317.349
Trichloroethane		43.21	
Trichloroethylene	120000	3.47	0.003
Trichlorotrifluoroethane	360000	53.31	0.015
Xylene	5000 (10)	607.75	12.155
Ammonia	34000	9185.00	27.015
Hydrogen cyanide	1000	0.02	0.002
Hydrogen sulphide	7	0.00	0.000

Notes:

(1) as ethyl acetate
(2) as 2-butanol
(3) as n-butaraldehyde
(4) as monomethylamine
(5) as acetic anhydride
(6) as monochlorobenzene
(7) as dichloroethylene
(8) as m-cresol
(9) as trichlorofluoromethane
(10) as m-xylene

TABLE 5.19: Evaporator Stack Emissions - Odour Evaluation

Contaminant	Odour Threshold (ug/cu.m)	VENTING MODE - 15 t/h Maximum Concentration (ug/cu.m)	VENTING MODE - 15 t/h Max. Conc. as % of Threshold	VENTING MODE - 36 t/h Maximum Concentration (ug/cu.m)	VENTING MODE - 36 t/h Max. Conc. as % of Threshold
Acenaphthene	530	0.0727	0.014	0.1746	0.033
Acrylonitrile	49000	0.7238	0.001	1.7372	0.004
Aldrin		0.0002		0.0004	
Benzene	16000	0.0915	0.001	0.2197	0.001
Benzo (k) fluoranthene		0.0015		0.0035	
Bis (2-chloroethyl) ether		0.1740		0.4176	
Butadiene	1000	0.7238	0.072	1.7372	0.174
Butyl benzyl phthalate		0.0109		0.0261	
Carbon tetrachloride	660000	0.0362	0.000	0.0869	0.000
Chloroform	690000	0.0362	0.000	0.0869	0.000
Chlorophenol	0.1 (1)	0.2899	289.884	0.6957	695.722
Formaldehyde	1300	0.7238	0.056	1.7372	0.134
Hexachlorobenzene		0.0015		0.0035	
Lindane		0.0001		0.0001	
Methylene chloride	780000	0.5812	0.000	1.3948	0.000
PCB		0.0001		0.0003	
Perchloroethylene	34000	0.2899	0.001	0.6957	0.002
Phenol	160	0.0290	0.018	0.0696	0.043
Styrene	210	0.1451	0.069	0.3483	0.166
Toluene	670	0.2899	0.043	0.6957	0.104
Trichloroethylene	120000	1.4512	0.001	3.4828	0.003
Trichlorophenol, 2,4,6	0.1	0.0058	5.812	0.0139	13.948
Xylene	5000 (2)	0.1451	0.003	0.3483	0.007
Arsenic		0.0000		0.0000	
Beryllium		0.0000		0.0000	
Cadmium		0.0000		0.0000	
Chromium		0.0000		0.0001	
Mercury		0.0000		0.0000	
Nickel		0.0000		0.0001	

Notes:

(1) as 2,4,6-trichlorophenol
(2) as m-xylene

TABLE 5.20: Incinerator Stack Emissions - Odour Evaluation

Contaminant	Odour Threshold (ug/cu.m)	AVERAGE EMISSIONS Maximum Concentration (ug/cu.m)	AVERAGE EMISSIONS Max. Conc. as % of Threshold	SHORT-TERM PEAK EMISSIONS Maximum Concentration (ug/cu.m)	SHORT-TERM PEAK EMISSIONS Max. Conc. as % of Threshold
RESIDUAL ORGANICS:					
Acetates	15000 (1)	0.0698	0.000	41.0550	0.274
Acetone	9000	0.0263	0.000	20.3697	0.226
Acrylonitrile	49000	0.0005	0.000	1.9253	0.004
Alcohols	380 (2)	0.0027	0.001	5.3834	1.417
Aldehydes	14 (3)	0.0000	0.000	0.9123	6.517
Amines	28 (4)	0.0001	0.000	0.0292	0.104
Anhydrides	620 (5)	0.0071	0.001	13.6850	2.207
Benzene	16000	0.0029	0.000	3.0437	0.019
Benzothiazoles	470	0.0001	0.000	1.3685	0.291
Benzo(a)anthracene		0.0000		0.0301	
Benzo(a)pyrene		0.0000		0.0185	
Butadiene	1000	0.0000	0.000	0.0228	0.002
Carbon tetrachloride	660000	0.0015	0.000	27.3700	0.004
Chlorinated benzenes	1000 (6)	0.0000	0.000	0.0694	0.007
Chlorinated ethylenes	4600 (7)	0.0284	0.001	45.1605	0.982
Chloroform	690000	0.0025	0.000	17.6285	0.003
Cresols	4.7 (8)	0.0021	0.045	6.1574	131.008
Ethylene glycol		0.0882		31.9465	
Ethylene oxide	490000	0.0000	0.000	0.0228	0.000
Formaldehyde	1300	0.0014	0.000	0.6831	0.053
Freons	30000 (9)	0.0097	0.000	45.1605	0.151
Glycerine		0.0006		7.0840	
Hexane	34000	0.0159	0.000	6.6077	0.019
Hydrazine		0.0000		1.7193	
Isopropyl alcohol	8300	0.0039	0.000	18.9336	0.228
Ketones		0.0263		34.2125	
Methyl ethyl ketone	6200	0.0263	0.000	17.0085	0.274
Methyl isobutyl ketone	430	0.0263	0.006	43.3358	10.078
Methylene chloride	780000	0.0241	0.000	43.7920	0.006
Naphthalene	210	0.0008	0.000	7.9302	3.776
PCB		0.0001		0.0522	
Perchloroethylene	34000	0.0679	0.000	36.5079	0.107
Petroleum distillate		0.1306		45.1605	
Phenol	160	0.0112	0.007	18.6453	11.653
Pyridine	71	0.0015	0.002	1.9493	2.745
Styrene	210	0.0012	0.001	5.3231	2.535
Tetraethyl lead		0.0000		0.3779	
Toluene	670	0.0575	0.009	14.9049	2.225
Trichloroethane		0.0641		45.1605	
Trichloroethylene	120000	0.0103	0.000	45.1605	0.038
Trichlorotrifluoroethane	360000	0.0632	0.000	45.1605	0.013
Xylene	5000 (10)	0.0449	0.001	14.7341	0.295
ACID GASES:					
Hydrogen chloride	16000	32.8613	0.205	170.3917	1.065
Hydrogen fluoride		2.1908		9.7367	
Nitrogen oxides		438.1500		2434.1667	
Sulphur dioxide	1300	328.6125	25.278	851.9583	65.535

TABLE 5.20 (Contd.): Incinerator Stack Emissions - Odour Evaluation

Contaminant	Odour Threshold (ug/cu.m)	AVERAGE EMISSIONS Maximum Concentration (ug/cu.m)	AVERAGE EMISSIONS Max. Conc. as % of Threshold	SHORT-TERM PEAK EMISSIONS Maximum Concentration (ug/cu.m)	SHORT-TERM PEAK EMISSIONS Max. Conc. as % of Threshold
METALS:					
Antimony		10.9538		34.0783	
Arsenic		2.1908		6.8157	
Beryllium		0.4382		0.0001	
Cadmium		0.4382		1.4605	
Chromium		2.1908		6.8157	
Cobalt		2.1908		6.8157	
Copper		10.9538		34.0783	
Iron		1.9717		2.4342	
Lead		10.9538		34.0783	
Manganese		10.9538		34.0783	
Mercury		0.4382		1.4605	
Nickel		2.1908		6.8157	
Selenium		2.1908		6.8157	
Tellurium		2.1908		6.8157	
Thallium		0.4382		1.4605	
Vanadium		10.9538		34.0783	
Zinc		10.9538		17.0392	
PIC's (not included with residuals):					
Carbon disulphide	360	0.0701	0.019	0.0779	0.022
Ethyl benzene	10000	0.0018	0.000	0.0024	0.000
Methyl bromide		0.0002		0.0024	
Methyl chloride	22000	0.3177	0.001	0.6816	0.003
PCDD		0.0000		0.0001	
PCDD + PCDF		0.0001		0.0001	
PCDF		0.0000		0.0002	
Pentachlorophenol		0.0131		0.0146	
Vinyl chloride		0.0153		0.0341	
MISCELLANEOUS					
Carbon monoxide		153.3525		681.5667	
Cyanide		10.9538		34.0783	
Particulate		32.8613		170.3917	
Total hydrocarbons		32.8613		136.3133	

Notes:

(1) as ethyl acetate
(2) as 2-butanol
(3) as n-butaraldehyde
(4) as monomethylamine
(5) as acetic anhydride
(6) as monochlorobenzene
(7) as dichloroethylene
(8) as m-cresol
(9) as trichlorofluoromethane
(10) as m-xylene

TABLE 5.21: Organic Unloading/Storage Area - Fugitive Emissions - Odour Evaluation

Contaminant	Odour Threshold (ug/cu.m)	AVERAGE EMISSIONS Maximum Concentration (ug/cu.m)	AVERAGE EMISSIONS Max. Conc. as % of Threshold	SHORT-TERM PEAK EMISSIONS Maximum Concentration (ug/cu.m)	SHORT-TERM PEAK EMISSIONS Max. Conc. as % of Threshold
Acetates	15000 (1)	60.5130	0.403	361.3863	2.409
Acetone	9000	1919.8728	21.332	23445.7961	260.509
Acrylonitrile	49000	8.3888	0.017	2158.5200	4.405
Alcohols	380 (2)	25.5053	6.712	3334.5955	877.525
Aldehydes	14 (3)	0.0006	0.004	4.6665	33.332
Amines	28 (4)	24.5809	87.789	592.6527	2116.617
Anhydrides	620 (5)	1.3042	0.210	1.8930	0.305
Benzene	16000	43.4164	0.271	3874.8261	24.218
Benzothiazoles	470	0.0158	0.003	1.0577	0.225
Benzo(a)anthracene		0.0070		0.0070	
Benzo(a)pyrene		0.0028		0.0028	
Butadiene	1000	14.3979	1.440	249.8146	24.981
Carbon tetrachloride	660000	26.1053	0.004	16525.8998	2.504
Chlorinated benzenes	1000 (6)	0.1010	0.010	0.4332	0.043
Chlorinated ethylenes	4600 (7)	1474.8566	32.062	73267.1919	1592.765
Chloroform	690000	74.3992	0.011	20669.3693	2.996
Cresols	4.7 (8)	0.4483	9.538	1.0061	21.406
Ethylene glycol		17.8392		29.6687	
Ethylene oxide	490000	7.9724	0.002	168.8607	0.034
Formaldehyde	1300	6.9789	0.537	148.6937	11.438
Freons	30000 (9)	6984.8583	23.283	186739.1430	622.464
Glycerine		0.1007		0.1014	
Hexane	34000	374.1490	1.100	13378.5414	39.349
Hydrazine		0.0003		161.5131	
Isopropyl alcohol	8300	28.2128	0.340	4341.1513	52.303
Ketones		14.1737		397.3657	
Methyl ethyl ketone	6200	532.1149	8.582	11366.2086	183.326
Methyl isobutyl ketone	430	96.1588	22.363	3107.2894	722.625
Methylene chloride	780000	1615.2386	0.207	60543.7284	7.762
Naphthalene	210	0.1672	0.080	25.4437	12.116
PCB		0.9899		1.0277	
Perchloroethylene	34000	163.1050	0.480	3776.7091	11.108
Petroleum distillate		105.9986		899.6819	
Phenol	160	2.9353	1.835	75.6013	47.251
Pyridine	71	5.1199	7.211	28.7428	40.483
Styrene	210	1.3742	0.654	443.6223	211.249
Tetraethyl lead		0.0021		0.0203	
Toluene	670	263.7234	39.362	4312.0473	643.589
Trichloroethane		1008.6415		21603.2488	
Trichloroethylene	120000	59.2823	0.049	10574.3445	8.812
Trichlorotrifluoroethane	360000	3245.2258	0.901	71844.5215	19.957
Xylene	5000 (10)	57.6069	1.152	1212.2162	24.244
Hydrogen cyanide	1000	0.0018	0.000	0.1306	0.013
Hydrogen sulphide	7	0.1051	1.501	7.8247	111.781

Notes:
(1) as ethyl acetate
(2) as 2-butanol
(3) as n-butaraldehyde
(4) as monomethylamine
(5) as acetic anhydride
(6) as monochlorobenzene
(7) as dichloroethylene
(8) as m-cresol
(9) as trichlorofluoromethane
(10) as m-xylene

trichlorofluoromethane), methyl ethyl ketone, methyl isobutyl ketone, styrene, toluene and hydrogen sulphide.

The above analysis indicates the potential for exceedances of odour thresholds off-site for a small number of compounds, but only under the most adverse plant operating and meteorological conditions. Furthermore, as noted above, a conservative approach has been used in the evaluation of potential odour impact. As well, many of the compounds assumed in the development of the odour thresholds may not be present in actual waste streams and fugitive emissions may be overstated for some compounds. Thus, the analysis suggests that odours would be largely limited to the OWMC property, with the potential for occasional odours beyond the property boundary under the most adverse conditions when handling or treating high concentrations of odorous compounds and when dispersion conditions are the least favourable. As noted in Section 5.6, mitigation measures are available to deal with off-site odours should they occur during actual operation of the facility.

5.4 EFFECTS OF 300 000 t/a VERSUS 150 000 t/a FACILITY

5.4.1 DISPERSION OF EMISSIONS

Earlier in this chapter (section 5.3.1.1), maximum concentrations are given for emissions from the incinerator and evaporator stacks, expressed in terms of the concentration ($\mu g/m^3$) for a unit emission rate (1 g/s). These dispersion factors are shown for the cases of one and two incinerator units (capacity of 30 000 t/a each) (see Table 5.7). In the two unit case, which corresponds to an overall facility capacity of 300 000 t/a, the maximum concentrations for all averaging times are less than the corresponding maximum concentrations for a single unit. This is a result of the greater buoyancy and, therefore, greater plume rise when both incinerator units are in operation. It is understood that the evaporator design would not change under the 300 000 t/a scenario, so the dispersion factors for this source would be the same as for the 150 000 t/a scenario.

The dispersion factors for fugitive emissions depend on the areal extent of the source over any given period. Thus, the concentrations per unit emission rate at the site boundary will be decreased when the same emissions are distributed over a larger area. However, since the areas involved in the 300 000 t/a case cannot be precisely defined at this time (some activities and associated emissions may simply be intensified within the same areas used in the 150 000 t/a facility), the dispersion factors are conservatively assumed to be the same for both facility capacities.

5.4.2 EFFECTS ON LOCAL AIR QUALITY

Tables 5.22 through 5.24 show the 1/2-hour point-of-impingement concentrations for emissions from the incinerator stack and fugitive emissions from the physical/chemical treatment plant and organic unloading/storage area, based on a facility capacity of 300 000 t/a. The emission rates from all facility components are assumed to be twice the corresponding emission rates for the 150 000 t/a facility. In fact, on average, fugitive organic emissions are expected to be less than this, since the emission rates used here assume direct venting to the atmosphere. Most of the time these emissions are routed to the incinerator and incinerator availability is substantially increased in the 300 000 t/a facility.

As shown in the tables, all contaminant concentrations are predicted to be within the applicable air quality standards and guidelines. The highest percentages of the allowable concentrations are predicted for arsenic (12 percent from the incinerators), chlorinated ethylenes (31 percent, fugitive emissions from the physical/chemical treatment plant and 60 percent, fugitive emissions from organic unloading/storage), amines (23 percent, fugitive emissions from organic unloading/storage), and chloroform (14 percent, fugitive emissions from organic unloading/storage). All others are less than 10 percent of the standards and guidelines. As in the 150 000 t/a scenario, most concentrations are less than 1 percent of the allowable levels.

TABLE 5.22: Maximum Predicted Concentrations Due to Incinerator Stack with Comparison to Standards and Guidelines - (300 000 t/a)

Contaminant	Standard or Guideline (ug/cu.m)	AVERAGE EMISSIONS Maximum Concentration (ug/cu.m)	AVERAGE EMISSIONS Max. Conc. as % of Allowable	SHORT-TERM PEAK EMISSIONS Maximum Concentration (ug/cu.m)	SHORT-TERM PEAK EMISSIONS Max. Conc. as % of Allowable
RESIDUAL ORGANICS:					
Acetates	100 (G)(1)	0.001247	0.001	0.73	0.733
Acetone	48000 (S)	0.000470	0.000	0.36	0.001
Acrylonitrile	300 (TS)	0.000009	0.000	0.03	0.011
Alcohols	19000 (G)(2)	0.000049	0.000	0.10	0.001
Aldehydes	42 (PG)(3)	0.000000	0.000	0.02	0.039
Amines	25 (S)(4)	0.000001	0.000	0.00	0.002
Anhydrides	100 (S)(5)	0.000126	0.000	0.24	0.244
Benzene	10000 (S)	0.000051	0.000	0.05	0.001
Benzothiazoles	200 (PG)	0.000001	0.000	0.02	0.012
Benzo(a)anthracene		0.000001		0.00	
Benzo(a)pyrene	0.0033 (PG)	0.000000	0.008	0.00	9.996
Butadiene		0.000001		0.00	
Carbon tetrachloride	20000 (S)	0.000026	0.000	0.49	0.002
Chlorinated benzenes	100 (G)(6)	0.000001	0.000	0.00	0.001
Chlorinated ethylenes	1200 (PG)(7)	0.000507	0.000	0.81	0.067
Chloroform	1500 (G)	0.000044	0.000	0.31	0.021
Cresols	230 (S)	0.000038	0.000	0.11	0.048
Ethylene glycol		0.001576		0.57	
Ethylene oxide	15 (PG)	0.000001	0.000	0.00	0.003
Formaldehyde	65 (S)	0.000024	0.000	0.01	0.019
Freons	1500000 (G)(8)	0.000174	0.000	0.81	0.000
Glycerine		0.000010		0.13	
Hexane	35000 (G)	0.000284	0.000	0.12	0.000
Hydrazine		0.000000		0.03	
Isopropyl alcohol	24000 (G)	0.000069	0.000	0.34	0.001
Ketones	470 (PG)(9)	0.000470	0.000	0.61	0.130
Methyl ethyl ketone	31000 (S)	0.000470	0.000	0.30	0.001
Methyl isobutyl ketone	1200 (G)	0.000470	0.000	0.77	0.064
Methylene chloride	100000 (S)	0.000431	0.000	0.78	0.001
Naphthalene		0.000014		0.14	
PCB	0.45 (G)	0.000001	0.000	0.00	0.207
Perchloroethylene	10000 (G)	0.001214	0.000	0.65	0.007
Petroleum distillate		0.002334		0.81	
Phenol	100 (S)	0.000201	0.000	0.33	0.333
Pyridine	60 (PG)	0.000027	0.000	0.03	0.058
Styrene	400 (S)	0.000021	0.000	0.10	0.024
Tetraethyl lead		0.000000		0.01	
Toluene	2000 (S)	0.001028	0.000	0.27	0.013
Trichloroethane		0.001146		0.81	
Trichloroethylene	85000 (S)	0.000185	0.000	0.81	0.001
Trichlorotrifluoroethane	2400000 (S)	0.001129	0.000	0.81	0.000
Xylene	2300 (S)	0.000803	0.000	0.26	0.011
ACID GASES:					
Hydrogen chloride	100 (S)	0.59	0.587	3.04	3.042
Hydrogen fluoride	4.3 (S)(10)	0.04	0.910	0.17	4.043
Nitrogen oxides	500 (S)(11)	7.82	1.565	43.46	8.692
Sulphur dioxide	330 [illegible]	5.37	0.707	15.21	[illegible].833

TABLE 5.22 (contd.): Maximum Predicted Concentrations Due to Incinerator Stack with Comparison to Standards and Guidelines - (300 000 t/a)

Contaminant	Standard or Guideline (ug/cu.m)	AVERAGE EMISSIONS Maximum Concentration (ug/cu.m)	AVERAGE EMISSIONS Max. Conc. as % of Allowable	SHORT-TERM PEAK EMISSIONS Maximum Concentration (ug/cu.m)	SHORT-TERM PEAK EMISSIONS Max. Conc. as % of Allowable
METALS:					
Antimony	75 (S)	0.20	0.261	0.61	0.311
Arsenic	1 (PG)	0.04	3.912	0.12	12.169
Beryllium	0.03 (S)	0.01	26.077	0.00	0.006
Cadmium	5 (S)	0.01	0.156	0.03	0.522
Chromium	5 (PG)(12)	0.04	0.782	0.12	2.434
Cobalt		0.04		0.12	
Copper	100 (S)	0.20	0.196	0.61	0.608
Iron	10 (S)	0.00	0.000	0.04	0.435
Lead	10 (S)	0.20	1.956	0.61	6.085
Manganese	100 (S)	0.20	0.196	0.61	0.608
Mercury	5 (S)	0.01	0.156	0.03	0.522
Nickel	5 (G)	0.04	0.782	0.12	2.434
Selenium	20 (S)(13)	0.04	0.196	0.12	0.608
Tellurium	30 (S)	0.04	0.130	0.12	0.406
Thallium		0.01		0.03	
Vanadium	5 (S)	0.20	3.912	0.61	12.169
Zinc	100 (S)	0.20	0.196	0.30	0.304
PIC's (not included with residuals):					
Carbon disulphide	330 (S)	0.00	0.000	0.001391	0.000
Ethyl benzene	4000 (S)	0.00	0.000	0.000043	0.000
Methyl bromide	4000 (G)	0.00	0.000	0.000043	0.000
Methyl chloride	20000 (G)	0.01	0.000	0.012169	0.000
PCDD	0.00045 (PG)	0.00	0.035	0.000002	0.396
PCDD + PCDF	0.00045 (PG)(14)	0.00	0.209	0.000002	0.415
PCDF		0.00		0.000004	
Pentachlorophenol	60 (G)	0.00	0.000	0.000261	0.000
Vinyl chloride	560 (G)	0.00	0.000	0.000608	0.000
MISCELLANEOUS					
Carbon monoxide	6000 (S)	2.74	0.046	12.17	0.203
Cyanide	1150 (S)(15)	0.20	0.017	0.61	0.053
Particulate	100 (S)	0.59	0.587	3.04	3.042
Total hydrocarbons		0.59		2.43	

Notes:

(S) standard (Regulation 308)
(TS) tentative standard
(G) guideline
(PG) provisional guideline

(1) as cellosolve acetate
(2) as ethyl alcohol
(3) as glutaraldehyde
(4) as monoethyl amine
(5) as phthalic anhydride
(6) as 1,2,4 trichlorobenzene
(7) as ethylene dichloride
(8) as Freon 12
(9) as diisobutyl ketone
(10) gaseous, April 1 - October 31
(11) as nitrogen dioxide
(12) di, tri and hexavalent forms
(13) except hydrogen telluride
(14) calculated as PCDD + PCDF/50
(15) as hydrogen cyanide

TABLE 5.23: Maximum Predicted Concentrations Due to Physical/Chemical Treatment Plant with Comparison to Standards and Guidelines - (300 000 t/a)

Contaminant	Standard or Guideline (ug/cu.m)	SHORT-TERM PEAK EMISSIONS Maximum Concentration (ug/cu.m)	Max. Conc. as % of Allowable
Acetates	100 (G)(1)	1.6711	1.671
Acetone	48000 (S)	0.0000	0.000
Acrylonitrile	300 (TS)	11.1644	3.721
Alcohols	19000 (G)(2)	17.8226	0.094
Aldehydes	42 (PG)(3)	0.0245	0.058
Amines	25 (S)(4)	2.1403	8.561
Anhydrides	100 (S)(5)	0.0000	0.000
Benzene	10000 (S)	0.0356	0.000
Benzothiazoles	200 (PG)	0.0000	0.000
Benzo(a)anthracene		0.0000	
Benzo(a)pyrene	0.0033 (PG)	0.0000	0.000
Butadiene		1.3192	
Carbon tetrachloride	20000 (S)	0.0000	0.000
Chlorinated benzenes	100 (G)(6)	0.0000	0.000
Chlorinated ethylenes	1200 (PG)(7)	371.2492	30.937
Chloroform	1500 (G)	0.0000	0.000
Cresols	230 (S)	0.0000	0.000
Ethylene glycol		0.0000	
Ethylene oxide	15 (PG)	0.0000	0.000
Formaldehyde	65 (S)	0.7224	1.111
Freons	1500000 (G)(8)	3.7479	0.000
Glycerine		0.0000	
Hexane	35000 (G)	0.0000	0.000
Hydrazine		0.0000	
Isopropyl alcohol	24000 (G)	22.3871	0.093
Ketones	470 (PG)(9)	0.0000	0.000
Methyl ethyl ketone	31000 (S)	0.0000	0.000
Methyl isobutyl ketone	1200 (G)	0.0000	0.000
Methylene chloride	100000 (S)	0.0000	0.000
Naphthalene		0.0002	
PCB	0.45 (G)	0.0000	0.000
Perchloroethylene	10000 (G)	19.2486	0.192
Petroleum distillate		4.3215	
Phenol	100 (S)	0.3818	0.382
Pyridine	60 (PG)	0.0000	0.000
Styrene	400 (S)	2.3337	0.583
Tetraethyl lead		0.0000	
Toluene	2000 (S)	21.6489	1.082
Trichloroethane		0.4399	
Trichloroethylene	85000 (S)	0.0353	0.000
Trichlorotrifluoroethane	2400000 (S)	0.5428	0.000
Xylene	2300 (S)	6.1880	0.269
Ammonia	3600 (S)	93.5200	2.598
Hydrogen cyanide	1150 (S)	0.0002	0.000
Hydrogen sulphide	30 (S)	0.0000	0.000

Notes:

(S) standard (Regulation 308)
(TS) tentative standard
(G) guideline
(PG) provisional guideline

(1) as cellosolve acetate
(2) as ethyl alcohol
(3) as glutaraldehyde
(4) as monoethyl amine
(5) as phthalic anhydride
(6) as 1,2,4 trichlorobenzene
(7) as ethylene dichloride
(8) as Freon 12
(9) as diisobutyl ketone

TABLE 5.24: Maximum Predicted Concentrations Due to Organic Unloading/Storage Area - Fugitive Emissions with Comparison to Standards and Guidelines - (300 000 t/a)

Contaminant	Standard or Guideline (ug/cu.m)	AVERAGE EMISSIONS Maximum Concentration (ug/cu.m)	AVERAGE EMISSIONS Max. Conc. as % of Allowable	SHORT-TERM PEAK EMISSIONS Maximum Concentration (ug/cu.m)	SHORT-TERM PEAK EMISSIONS Max. Conc. as % of Allowable
Acetates	100 (G)(1)	0.592966	0.593	3.541222	3.541
Acetone	48000 (S)	18.812824	0.039	229.745238	0.479
Acrylonitrile	300 (TS)	0.082201	0.027	21.151327	7.050
Alcohols	19000 (G)(2)	0.249927	0.001	32.675685	0.172
Aldehydes	42 (PG)(3)	0.000006	0.000	0.045727	0.109
Amines	25 (S)(4)	0.240868	0.963	5.807401	23.230
Anhydrides	100 (S)(5)	0.012780	0.013	0.018549	0.019
Benzene	10000 (S)	0.425437	0.004	37.969401	0.380
Benzothiazoles	200 (PG)	0.000155	0.000	0.010365	0.005
Benzo(a)anthracene		0.000068		0.000068	
Benzo(a)pyrene	0.0033 (PG)	0.000027	0.826	0.000027	0.826
Butadiene		0.141085		2.447932	
Carbon tetrachloride	20000 (S)	0.255806	0.001	161.937209	0.810
Chlorinated benzenes	100 (G)(6)	0.000990	0.001	0.004245	0.004
Chlorinated ethylenes	1200 (PG)(7)	14.452113	1.204	717.944845	59.829
Chloroform	1500 (G)	0.729038	0.049	202.539046	13.503
Cresols	230 (S)	0.004393	0.002	0.009859	0.004
Ethylene glycol		0.174806		0.290723	
Ethylene oxide	15 (PG)	0.078121	0.521	1.654665	11.031
Formaldehyde	65 (S)	0.068386	0.105	1.457049	2.242
Freons	1500000 (G)(8)	68.444591	0.005	1829.855924	0.122
Glycerine		0.000987		0.000993	
Hexane	35000 (G)	3.666284	0.010	131.096260	0.375
Hydrazine		0.000003		1.582666	
Isopropyl alcohol	24000 (G)	0.276457	0.001	42.538920	0.177
Ketones	470 (PG)(9)	0.138888	0.030	3.893784	0.828
Methyl ethyl ketone	31000 (S)	5.214191	0.017	111.377421	0.359
Methyl isobutyl ketone	1200 (G)	0.942259	0.079	30.448314	2.537
Methylene chloride	100000 (S)	15.827715	0.016	593.267690	0.593
Naphthalene		0.001638		0.249323	
PCB	0.45 (G)	0.009700	2.156	0.010070	2.238
Perchloroethylene	10000 (G)	1.598265	0.016	37.007954	0.370
Petroleum distillate		1.038680		8.815978	
Phenol	100 (S)	0.028763	0.029	0.740817	0.741
Pyridine	60 (PG)	0.050170	0.084	0.281651	0.469
Styrene	400 (S)	0.013466	0.003	4.347053	1.087
Tetraethyl lead		0.000020		0.000199	
Toluene	2000 (S)	2.584224	0.129	42.253730	2.113
Trichloroethane		9.883673		211.690127	
Trichloroethylene	85000 (S)	0.580907	0.001	103.617949	0.122
Trichlorotrifluoroethane	2400000 (S)	31.799951	0.001	704.004106	0.029
Xylene	2300 (S)	0.564490	0.025	11.878500	0.516
Hydrogen cyanide	1150 (S)	0.000018	0.000	0.001280	0.000
Hydrogen sulphide	30 (S)	0.001030	0.003	0.076674	0.256

Notes:
(S) standard (Regulation 308)
(TS) tentative standard
(G) guideline
(PG) provisional guideline

(1) as cellosolve acetate
(2) as ethyl alcohol
(3) as glutaraldehyde
(4) as monomethyl amine
(5) as phthalic anhydride

(6) as 1,2,4 trichlorobenzene
(7) as ethylene dichloride
(8) as Freon 12
(9) as diisobutyl ketone

The effects of the evaporator stack emissions, both in terms of contaminant concentrations and the visibility of the steam plume, are expected to be similar to the effects noted earlier for the 150 000 t/a facility (see section 5.3.2.3) when the evaporator is in operation. However, in general, the operating hours of this unit may be lower in the 300 000 t/a case, since more liquid effluent will be directed to the incinerator scrubbers, rather than the evaporator.

The impacts associated with fugitive dust emissions during operation have not been evaluated in detail here, due to the uncertainty surrounding the landfill operating plan for the 300 000 t/a facility at the time this assessment was conducted. However, assuming conservatively that dust emissions are twice the emissions for the 150 000 t/a case, and that the increased emissions are distributed over twice the area, the dust nuisance criterion of 500 $\mu g/m^3$ of suspended particulate discussed in section 5.3.2.4 could be exceeded at distances up to approximately 550 m from the site boundary. As with the 150 000 t/a facility, this is predicted only under the most adverse conditions and such episodes as do occur should be infrequent and of short duration. Further, it is possible that the increased activity for the 300 000 t/a facility could take place over a longer working day, in which case the affected area would be less than predicted in any given hour and would approach the affected area for the 150 000 t/a case (approximately 460 m from the site boundary).

An analysis of the potential for odours beyond the OWMC site boundary was carried out for the 300 000 t/a facility in a manner similar to that undertaken for the 150 000 t/a case (see Section 5.3.4). Results for the evaporator stack are the same, since it is understood that no change in the design of this unit will be required for the larger facility. Table 5.25, for the enlarged physical/chemical treatment plant, indicates exceedances of the odour thresholds for the same five contaminants as for the 150 000 t/a facility, i.e., alcohols (as 2-butanol), amines (as monomethyl amine), chlorinated ethylenes (as

TABLE 5.25: Physical/Chemical Treatment Plant - Fugitive Emissions - Odour Evaluation - (300 000 t/a)

Contaminant	Odour Threshold (ug/cu.m)	SHORT-TERM PEAK EMISSIONS Maximum Concentration (ug/cu.m)	Max. Conc. as % of Threshold
Acetates	15000 (1)	328.24	2.188
Acetone	9000	0.00	0.000
Acrylonitrile	49000	2193.01	4.476
Alcohols	380 (2)	3500.87	921.283
Aldehydes	14 (3)	4.82	34.401
Amines	28 (4)	420.42	1501.505
Anhydrides	620 (5)	0.00	0.000
Benzene	16000	7.00	0.044
Benzothiazoles	470	0.00	0.000
Benzo(a)anthracene		0.00	
Benzo(a)pyrene		0.00	
Butadiene	1000	259.13	25.913
Carbon tetrachloride	660000	0.00	0.000
Chlorinated benzenes	1000 (6)	0.00	0.000
Chlorinated ethylenes	4600 (7)	72923.95	1585.303
Chloroform	690000	0.00	0.000
Cresols	4.7 (8)	0.00	0.000
Ethylene glycol		0.00	
Ethylene oxide	490000	0.00	0.000
Formaldehyde	1300	141.91	10.916
Freons	30000 (9)	736.20	2.454
Glycerine		0.00	
Hexane	34000	0.00	0.000
Hydrazine		0.00	
Isopropyl alcohol	8300	4397.48	52.982
Ketones		0.00	
Methyl ethyl ketone	6200	0.00	0.000
Methyl isobutyl ketone	430	0.00	0.000
Methylene chloride	780000	0.00	0.000
Naphthalene	210	0.05	0.022
PCB		0.00	
Perchloroethylene	34000	3780.98	11.121
Petroleum distillate		848.88	
Phenol	160	75.00	46.877
Pyridine	71	0.00	0.000
Styrene	210	458.40	218.285
Tetraethyl lead		0.00	
Toluene	670	4252.47	634.697
Trichloroethane		86.41	
Trichloroethylene	120000	6.94	0.006
Trichlorotrifluoroethane	360000	106.63	0.030
Xylene	5000 (10)	1215.50	24.310
Ammonia	34000	18370.00	54.029
Hydrogen cyanide	1000	0.04	0.004
Hydrogen sulphide	7	0.00	0.000

Notes:
(1) as ethyl acetate
(2) as 2-butanol
(3) as n-butaraldehyde
(4) as monoethylamine
(5) as acetic anhydride
(6) as monochlorobenzene
(7) as dichloroethylene
(8) as m-cresol
(9) as trichlorofluoroethane
(10) as m-xylene

dichloroethylene), styrene and toluene. The exceedances apply to short-term peak emissions only. Emissions from the incinerator (Table 5.26) are not predicted to result in exceedances of odour thresholds, except in the case of cresols (179 percent of the odour threshold for short-term peak emissions, as m-cresol). This result is similar to the 150 000 t/a scenario. Table 5.27, for the organic unloading/storage area, shows exceedances of the odour thresholds for short-term peak emissions of acetone, alcohols (as 2-butanol), amines (as monomethyl amine), chlorinated ethylenes (as dichloroethylene), freons (as trichlorofluoromethane), isopropyl alcohol, methyl ethyl ketone, methyl isobutyl ketone, styrene, toluene and hydrogen sulphide. An exceedance is also predicted for average emissions of amines (as monomethyl amine). With two exceptions, these exceedances were also predicted for the 150 000 t/a facility.

The analysis of emissions from the 300 000 t/a facility indicates the potential for exceedances of odour thresholds off-site for a small number of compounds, but under the most adverse plant operating and meteorological condition only. As is the case for the 150 000 t/a facility, having regard for the conservative assumptions used in the analysis, these results suggest that odours would be largely limited to the OWMC property. However, there is the potential for occasional odours beyond the plant boundary when handling or treating high concentrations of odorous compounds and when dispersion conditions are least favourable. Mitigation measures are available to deal with off-site odours should they occur during actual operation of the facility (see Section 5.6).

To assess the overall effect of the 300 000 t/a facility on local air quality, Table 5.28 shows the maximum hourly, 24-hourly and annual average concentrations and compares these to the criteria for desirable air qualiy as set out in Regulation 296. The table incorporated the maximum predicted concentrations for the expanded facility, as well as the maximum levels recorded during the baseline monitoring program at the OWMC site (similar to Table 5.17 for the 150 000 t/a facility). Again, the results summarized in this table suggest that facility emissions would not result in exceedances of the

TABLE 5.26: Incinerator Stack Emissions - Odour Evaluation - (300 000 t/a)

Contaminant	Odour Threshold (ug/cu.m)	AVERAGE EMISSIONS Maximum Concentration (ug/cu.m)	AVERAGE EMISSIONS Max. Conc. as % of Threshold	SHORT-TERM PEAK EMISSIONS Maximum Concentration (ug/cu.m)	SHORT-TERM PEAK EMISSIONS Max. Conc. as % of Threshold
RESIDUAL ORGANICS:					
Acetates	15000 (1)	0.095567	0.001	56.17	0.374
Acetone	9000	0.036031	0.000	27.87	0.310
Acrylonitrile	49000	0.000691	0.000	2.63	0.005
Alcohols	380 (2)	0.003726	0.001	7.37	1.938
Aldehydes	14 (3)	0.000002	0.000	1.25	8.916
Amines	28 (4)	0.000081	0.000	0.04	0.143
Anhydrides	620 (5)	0.009686	0.002	18.72	3.020
Benzene	16000	0.003932	0.000	4.16	0.026
Benzothiazoles	470	0.000105	0.000	1.87	0.398
Benzo(a)anthracene		0.000052		0.04	
Benzo(a)pyrene		0.000021		0.03	
Butadiene	1000	0.000061	0.000	0.03	0.003
Carbon tetrachloride	660000	0.002002	0.000	37.45	0.006
Chlorinated benzenes	1000 (6)	0.000067	0.000	0.09	0.009
Chlorinated ethylenes	4600 (7)	0.038872	0.001	61.78	1.343
Chloroform	690000	0.003358	0.000	24.12	0.003
Cresols	4.7 (8)	0.002919	0.062	8.42	179.234
Ethylene glycol		0.120750		43.71	
Ethylene oxide	490000	0.000052	0.000	0.03	0.000
Formaldehyde	1300	0.001860	0.000	0.93	0.072
Freons	30000 (9)	0.013302	0.000	61.78	0.206
Glycerine		0.000755		9.69	
Hexane	34000	0.021761	0.000	9.04	0.027
Hydrazine		0.000000		2.35	
Isopropyl alcohol	8300	0.005314	0.000	25.90	0.312
Ketones		0.036031		46.81	
Methyl ethyl ketone	6200	0.036031	0.001	23.27	0.375
Methyl isobutyl ketone	430	0.036031	0.008	59.29	13.788
Methylene chloride	780000	0.032996	0.000	59.91	0.008
Naphthalene	210	0.001046	0.000	10.85	5.166
PCB		0.000074		0.07	
Perchloroethylene	34000	0.092984	0.000	49.95	0.147
Petroleum distillate		0.178865		61.78	
Phenol	160	0.015368	0.010	25.51	15.943
Pyridine	71	0.002034	0.003	2.67	3.756
Styrene	210	0.001640	0.001	7.28	3.468
Tetraethyl lead		0.000014		0.52	
Toluene	670	0.078778	0.012	20.39	3.044
Trichloroethane		0.087818		61.78	
Trichloroethylene	120000	0.014141	0.000	61.78	0.051
Trichlorotrifluoroethane	360000	0.086527	0.000	61.78	0.017
Xylene	5000 (10)	0.061537	0.001	20.16	0.403
ACID GASES:					
Hydrogen chloride	16000	44.958000	0.281	233.12	1.457
Hydrogen fluoride		2.997200		13.32	
Nitrogen oxides		599.440000		3330.22	
Sulphur dioxide	1300	149.580000	34.583	1165.58	89.660

TABLE 5.26 (Contd.): Incinerator Stack Emissions - Odour Evaluation - (300 000 t/a)

Contaminant	Odour Threshold (ug/cu.m)	AVERAGE EMISSIONS Maximum Concentration (ug/cu.m)	AVERAGE EMISSIONS Max. Conc. as % of Threshold	SHORT-TERM PEAK EMISSIONS Maximum Concentration (ug/cu.m)	SHORT-TERM PEAK EMISSIONS Max. Conc. as % of Threshold
METALS:					
Antimony		14.986000		46.62	
Arsenic		2.997200		9.32	
Beryllium		0.599440		0.00	
Cadmium		0.599440		2.00	
Chromium		2.997200		9.32	
Cobalt		2.997200		9.32	
Copper		14.986000		46.62	
Iron		0.000000		3.33	
Lead		14.986000		46.62	
Manganese		14.986000		46.62	
Mercury		0.599440		2.00	
Nickel		2.997200		9.32	
Selenium		2.997200		9.32	
Tellurium		2.997200		9.32	
Thallium		0.599440		2.00	
Vanadium		14.986000		46.62	
Zinc		14.986000		23.31	
PIC's (not included with residuals):					
Carbon disulphide	360	0.095910	0.027	0.11	0.030
Ethyl benzene	10000	0.002398	0.000	0.00	0.000
Methyl bromide		0.000300		0.00	
Methyl chloride	22000	0.434594	0.002	0.93	0.004
PCDD		0.000012		0.00	
PCDD + PCDF		0.000072		0.00	
PCDF		0.000060		0.00	
Pentachlorophenol		0.017983		0.02	
Vinyl chloride		0.020980		0.05	
MISCELLANEOUS					
Carbon monoxide		209.804000		932.46	
Cyanide		14.986000		46.62	
Particulate		44.958000		233.12	
Total hydrocarbons		44.958000		186.49	

Notes:

(1) as ethyl acetate
(2) as 2-butanol
(3) as n-butaraldehyde
(4) as monomethylamine
(5) as acetic anhydride
(6) as monochlorobenzene
(7) as dichloroethylene
(8) as m-cresol
(9) as trichlorofluoromethane
(10) as m-xylene

TABLE 5.27: Organic Unloading/Storage Area - Fugitive Emissions - Odour Evaluation - (300 000 t/a)

Contaminant	Odour Threshold (ug/cu.m)	AVERAGE EMISSIONS Maximum Concentration (ug/cu.m)	AVERAGE EMISSIONS Max. Conc. as % of Threshold	SHORT-TERM PEAK EMISSIONS Maximum Concentration (ug/cu.m)	SHORT-TERM PEAK EMISSIONS Max. Conc. as % of Threshold
Acetates	15000 (1)	121.0259	0.807	722.7726	4.818
Acetone	9000	3839.7457	42.664	46891.5923	521.018
Acrylonitrile	49000	16.7775	0.034	4317.0400	8.810
Alcohols	380 (2)	51.0106	13.424	6669.1911	1755.050
Aldehydes	14 (3)	0.0012	0.009	9.3330	66.664
Amines	28 (4)	49.1618	175.578	1185.3054	4233.233
Anhydrides	620 (5)	2.6084	0.421	3.7860	0.611
Benzene	16000	86.8329	0.543	7749.6521	48.435
Benzothiazoles	470	0.0315	0.007	2.1155	0.450
Benzo(a)anthracene		0.0139		0.0139	
Benzo(a)pyrene		0.0056		0.0056	
Butadiene	1000	28.7957	2.880	499.6291	49.963
Carbon tetrachloride	660000	52.2107	0.008	33051.7997	5.008
Chlorinated benzenes	1000 (6)	0.2020	0.020	0.8665	0.087
Chlorinated ethylenes	4600 (7)	2949.7133	64.124	146534.3838	3185.530
Chloroform	690000	148.7985	0.022	41338.7386	5.991
Cresols	4.7 (8)	0.8966	19.077	2.0121	42.812
Ethylene glycol		35.6784		59.3374	
Ethylene oxide	490000	15.9448	0.003	337.7214	0.069
Formaldehyde	1300	13.9578	1.074	297.3874	22.876
Freons	30000 (9)	13969.7166	46.566	373478.2860	1244.928
Glycerine		0.2014		0.2027	
Hexane	34000	748.2979	2.201	26757.0829	78.697
Hydrazine		0.0007		323.0261	
Isopropyl alcohol	8300	56.4256	0.680	8682.3027	104.606
Ketones		28.3474		794.7314	
Methyl ethyl ketone	6200	1064.2297	17.165	22732.4172	366.652
Methyl isobutyl ketone	430	192.3175	44.725	6214.5789	1445.251
Methylene chloride	780000	3230.4773	0.414	121087.4568	15.524
Naphthalene	210	0.3343	0.159	50.8874	24.232
PCB		1.9798		2.0553	
Perchloroethylene	34000	326.2101	0.959	7553.4182	22.216
Petroleum distillate		211.9973		1799.3637	
Phenol	160	5.8706	3.669	151.2026	94.502
Pyridine	71	10.2398	14.422	57.4857	80.966
Styrene	210	2.7484	1.309	887.2446	422.497
Tetraethyl lead		0.0041		0.0405	
Toluene	670	527.4468	78.723	8624.0946	1287.178
Trichloroethane		2017.2830		43206.4977	
Trichloroethylene	120000	118.5646	0.099	21148.6890	17.624
Trichlorotrifluoroethane	360000	6490.4516	1.803	143689.0431	39.914
Xylene	5000 (10)	115.2139	2.304	2424.4324	48.489
Hydrogen cyanide	1000	0.0036	0.000	0.2612	0.026
Hydrogen sulphide	7	0.2101	3.002	15.6494	223.562

Notes:
(1) as ethyl acetate
(2) as 2-butanol
(3) as n-butaraldehyde
(4) as monoethylamine
(5) as acetic anhydride
(6) as monochlorobenzene
(7) as dichloroethylene
(8) as m-cresol
(9) as trichlorofluoromethane
(10) as m-xylene

TABLE 5.28: Overall Evaluation of OWMC Emissions with Comparison to Desirable Air Quality Criteria - (300 000 t/a)

Contaminant	Criterion (ug/cu.m)	Averaging Time	Maximum Concentrations (ug/cu.m) Existing(1)	OWMC	OWMC as % of Existing	Existing as % of Criterion	OWMC Existing as % of Criterion
Arsenic	25	24 hrs	0.003	0.064	2443.36	0.01	0.26
Cadmium	2	24 hrs	0.001	0.013	1020.15	0.07	0.73
Carbon monoxide	36200	1 hr	10300.000 *	93.456	0.91	28.45	28.71
	15700	8 hrs	1100.000 *	14.829	1.35	7.01	7.10
Fluorides (gaseous)	0.86 (2)	24 hrs	0.080	0.080	99.93	9.30	18.60
Hydrogen sulphide	30	1 hr	5.600	1.565	27.95	18.67	23.88
Lead	5	24 hrs	0.033	0.317	961.27	0.66	7.00
Mercury	2	24 hrs	0.016	0.013	82.89	0.80	1.46
Nickel	2	24 hrs	0.006	0.064	1155.04	0.27	3.45
Nitrogen dioxide	400	1 hr	107.000	333.232	311.43	26.75	110.06
	200	24 hrs	62.000	18.501	29.84	31.00	40.25
Ozone	165	1 hr	237.000	0.000	0.00	143.64	143.64
Sulphur dioxide	690	1 hr	277.000	116.584	42.09	40.14	57.04
	275	24 hrs	72.000	8.453	11.74	26.18	29.26
	55	1 yr	12.600	0.065	0.51	22.91	23.03
Suspended	120	24 hrs	123.000	1.326	1.08	102.50	103.61
particulate	60	1 yr	29.000	0.006	0.02	48.33	48.34
Vanadium	2	24 hrs	0.005	0.317	6344.38	0.25	16.11

Notes:

(1) from site baseline monitoring (1986-87), if unavailable estimate from literature (*)
(2) lowest criteria, for period April 15 - October 15

criteria, with the possible exception of nitrogen dioxide (maximum 1-hour concentration). Where existing concentrations are outside the desirable range, the increment due to OWMC's emissions would not add significantly to these concentrations.

5.5 ASSESSMENT WITH RESPECT TO INTERNATIONAL REGULATIONS AND STANDARDS

5.5.1 GENERAL

In the following section, the proposed OWMC facility is assessed with respect to requirements identified in the survey of international regulations and standards in Chapter 2. The assessment covers specific performance and emission criteria only, insofar as these could be identified in the information available. The reader is cautioned that, in practice, the interpretation of these criteria and the application of other permitting requirements in the various jurisdictions may result in conclusions regarding the proposed OWMC facility which differ from those presented. Accordingly, the following assessment should be regarded as preliminary only. Further investigation is recommended to resolve these uncertainties.

5.5.2 GENERAL AMBIENT AIR QUALITY STANDARDS/OBJECTIVES - NORTH AMERICA

Information was presented in Chapter 2 of this report on general ambient air quality standards and objectives in several North American jurisdictions. In addition, the criteria for desirable air quality in Ontario were given, as set out in Regulation 296 under the Ontario Environmental Protection Act. It is noted that the Ontario criteria for the common air pollutants (carbon monoxide, nitrogen dioxide, suspended particulate matter, ozone and sulphur dioxide), are very similar to the top of the acceptable range for corresponding time periods in the Canadian Ambient Air Quality Objectives. An exception is the 1-hour criterion for sulphur dioxide (690 $\mu g/m^3$), which is at about the mid-point of the Canadian acceptable range (450-900 $\mu g/m^3$) (see Tables 2.1 and 2.2).

Furthermore, inspection of the tables of general air quality standards for Quebec and the U.S. (in Appendix C), indicates that these are generally approximately the same or larger than the corresponding Ontario criteria. Exceptions are the U.S. primary and secondary 8-hour standard for carbon monoxide (10 000 $\mu g/m^3$, compared to 15 700 $\mu g/m^3$ in Ontario) and the 1-hour standard for hydrogen sulphide in Quebec (14 $\mu g/m^3$, compared with 30 $\mu g/m^3$ in Ontario). Therefore, since the evaluation of emissions from the OWMC facility has indicated that facility emissions would not result in exceedances of the Ontario criteria (Section 5.3.3), it is concluded that emissions would also meet the general air quality standards in Quebec and the U.S.

5.5.3 REQUIREMENTS FOR RELATED FACILITIES IN ONTARIO AND CANADA (PCB DESTRUCTION FACILITIES)

Since it is expected that OWMC's rotary kiln incinerator will be used to destroy wastes containing polychlorinated biphenyls (PCB's), it is pertinent to review the regulations governing such activities in Canada, including Ontario. Specific requirements are summarized in Table 2.3 of Chapter 2. The performance criteria (in Quebec and Alberta) encompass:

- a destruction/removal efficiency of 99.9999 percent,
- a minimum combustion temperature of 1250°C for a residence time of 2.5 seconds and minimum 3 percent excess oxygen, and
- flue gas scrubbing and electrostatic precipitators, or equivalent.

The most stringent air emission criteria appear to require flue gas concentrations of no more than 50 mg/Nm^3 of particulate matter, 75 mg/Nm^3 of hydrogen chloride and 140 mg/Nm^3 of carbon monoxide.

It is understood that the OWMC incinerator will meet the first set of performance criteria and the emission criteria for hydrogen chloride and carbon monoxide. However, it is currently unclear whether

or not the maximum flue gas concentrations of particulate matter (shown in Table 5.1 as 70 mg/Nm^3) would meet the Quebec requirement of no more than 50 mg/Nm^3, since the flue gas conditions and averaging times for the latter are not specified and the OWMC maximum concentration is a general figure and may not apply when PCB wastes are being treated.

Apart from the general standards for air emissions in Ontario (under Regulation 308, as addressed earlier in this Chapter), regulations are now in force governing mobile PCB destruction facilities in the Province. For mobile incinerators, these include a destruction and removal efficiency of 99.9999 percent which, it is understood, will also be achieved by the OWMC incinerator. In addition, the regulations require stack and ambient monitoring of certain contaminants at certain times during demonstration tests and actual operation (see Table 2.4). Although all these requirements may not be applicable to the fixed facility proposed by OWMC, they should be consulted when designing the monitoring program for PCB destruction by the OWMC incinerator.

5.5.4 RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) - U.S.A.

The general requirement of RCRA for incineration of hazardous waste are:

- a destruction and removal efficiency for each principal organic hazardous constituent (POHC) of 99.99 percent,
- a hydrogen chloride emission rate of 1.8 kg/h or less, or 99 percent removal if greater,
- particulate emissions less than 180 mg per dry standard cubic metre of stack gases,
- control of fugitive emissions,
- automatic feed shut-off when not operating under permit conditions, and
- feed of hazardous waste to incinerator only when it is running under steady-state conditions.

It is understood that the OWMC incinerator will meet these requirements, although the definition of POHC's in this context will need to be developed, consistent with the implementation of RCRA in the U.S.

5.5.5 REGULATION OF TOXIC AIR POLLUTANTS (TAPS)

As discussed in Chapter 2 (Section 2.6.3.2), the emissions of TAPS, of which hazardous waste incinerators are one source, are controlled by the regulation of ambient air concentrations, emission rates or concentrations at the source, control technology or risk assessment requirements.

Specific numerical ambient air concentrations (acceptable ambient limits, AAL's) have been compiled in Appendix C for the State of New York and the City of Philadelphia.

Average ambient concentrations due to the OWMC incinerator and fugitive emissions from the organic unloading/storage area were compared to these acceptable ambient limits. No exceedances were found relative to the average incinerator emissions. In the case of emissions from the organic unloading/storage area, exceedances were found for amines (when compared to the Philadelphia limits) and for chlorinated ethylenes and petroleum distillates (when compared to the New York limits).

The review of European standards provided specific numerical ambient air concentrations for West Germany, as outlined in Appendix D. When these were compared with predicted contaminant concentrations due to emissions from the OWMC facility, no exceedances were found.

Specific emission standards have been compiled in Appendix D for various European jurisdictions, including Denmark, Sweden, Norway and Great Britain. Short-term peak and average emissions expected from the OWMC incinerator were compared to these standards. The peak incinerator emissions of sulphur dioxide (SO_2) exceed the Norwegian standards, while peak emissions of total suspended particulate (TSP) emissions exceed Swedish and Norwegian standards. Carbon monoxide (CO) emissions exceed Norwegian standards and lead (Pb) emissions, as well as arsenic (As) emissions, exceed the respective Danish standards. Norwegian and Danish standards for cadmium (Cd) are also exceeded, as are Danish, Swedish and Norwegian standards for mercury (Hg).

When average incinerator emissions were compared to these European standards, fewer exceedances were found. Average incinerator emissions for cadmium exceed Norwegian standards and arsenic emissions are the same as those prescribed by the Danish standards. Danish, Swedish and Norwegian standards are exceeded in the case of mercury emissions.

Maximum incinerator emissions were also compared to West German standards and potential exceedances for a number of organic compounds and metals were identified. However, it is unclear at this time whether or not these apparent exceedances would be interpreted as violations of the German standards, since there are considerable uncertainties regarding averaging times, the presence of specific organic compounds in the OWMC waste stream, and the classification of emissions under the standards. None of the average incinerator emissions exceeds the West German standards.

Control technology requirements to meet operating and performance criteria have also been discussed as a method of controlling TAPS. An overview of operating and performance criteria for various jurisdictions in North America was given in Chapter 2. The most stringent performance criteria of the jurisdictions reviewed include a destruction and removal efficiency (DRE) of 99.99 percent for principal organic hazardous constituents (POHC's) and a DRE of 99.9999 percent for PCB's. The most stringent operating criteria include combustion temperatures of greater than 2200°F (1111°C) for chlorinated wastes and greater than 2200°F (1222°C) for halogenated aromatics. It is our understanding that the OWMC facility will meet these criteria.

5.6 MITIGATION OF EFFECTS

In the estimates of emissions from the incinerator and evaporator stacks in previous sections of this report, it has been assumed that the normal

operating conditions at the site will include best possible control of such emissions. The off-site concentrations are based on the facility as it has been designed to date (i.e., with emission controls in place, such as a scrubber system for incinerator emissions, and mist eliminator for evaporator stack emissions). Fugitive emissions of volatile organic compounds will be controlled by routing of vapours to the incinerator. When the incinerator is shut down, these emissions would be vented through activated carbon adsorbers. In addition, the incinerator is assumed to be capable of a high destruction and removal efficiency (at least 99.99 percent for all organic compounds and 99.9999 percent for PCB's).

Emissions of fugitive dust and vapours are, in some respects, harder to control and predict than stack emissions. Emissions were calculated assuming a certain level of control (see Appendix O). It is expected that normal day-to-day operations would require the following measures in order to achieve the projected emission rates found elsewhere in this report:

- wetting of unpaved roads at least twice daily during dry periods,
- control of equipment and vehicle speeds on-site,
- minimization of dust suspension in the landfill area by wetting and covering (including compaction and vegetation of inactive areas),
- removal of excess soil tracked onto access roads by vehicles leaving the site, and
- in the case of fugitive volatile emissions, appropriate ducting and incineration or capturing of vapours where practical.

As it is not possible to accurately predict the effectiveness of such control programs, it is recommended that the monitoring and

assessment of fugitive emissions be part of an ongoing review of OWMC's activities. If necessary, there are several additional mitigation methods which could be used in operation to further control stack and/or fugitive chemical emissions. These include:

- the blending of wastes to dilute particular compounds of concern,
- limiting the inventory of such compounds at the facility at any given time, and
- the scheduling of the handling and processing of these compounds under favourable atmospheric dispersion conditions (supplementary control system).

To control fugitive dust emissions, the following could be considered:

- further limitation of exposed areas,
- further traffic controls (vehicle speed, number of vehicles, etc.), and
- construction of fences on landfill work areas to act as wind screens.

It is recommended that a complaint bureau be established to receive any public complaints of nuisance impacts (i.e., odour, dust etc.), with the capability to respond effectively to such problems as they arise.

5.7 MONITORING

Baseline air quality monitoring has been carried out at OWMC's preferred site since March, 1986. While it is expected that the Ministry of the

Environment and the general public will contribute to the final definition of the scope of any future monitoring program, the outline for such a program is recommended below.

Further monitoring through the pre-operational period has been recommended (see Appendix L). Once the facility is operational, it is recommended that an intensive one-year period of operational monitoring be carried out with the primary purpose of verifying the effects of facility emissions on local air quality. This should consist of the following major components:

- continuous monitoring of "criteria" pollutants at the three monitoring stations (SO_2, NO and NO_2, O_3, CO, total reduced sulphur (TRS) and total hydrocarbons (THC)), plus 24-hour TSP and FP every third day at each station and monthly wet deposition,

- periodic monitoring for trace metals and organic compounds, including use of a mobile GC/MSD monitor for organics,

- periodic odour evaluations, probably based on a combination of analytical and sensory techniques,

- continuous monitoring of meteorological variables (wind speed, wind direction, air temperature, solar radiation) as well as rainfall and snowfall at the existing monitoring station, and

- continuous monitoring of incinerator stack emissions for such critical parameters as opacity, THC, CO, NO_x, and HCl, as well as temperature and velocity of the flue gases.

In addition, it is anticipated that a number of incinerator test burns will take place (number to be determined). During these tests additional

monitoring will be required of both the incinerator flue gases and ambient air. This would include:

- sampling and analysis of the designated principal organic hazardous compounds (POHC's) in the flue gases and in the waste feed,

- sampling and analysis of a range of products of incomplete combustion (PIC's) (i.e., dioxin and furans, PAH's, and precursor compounds, such as chlorobenzenes and chlorophenols, in the flue gases),

- sampling and analysis of a range of trace metals in the flue gases,

- intensive monitoring for trace metals and organic compounds in ambient air upwind and downwind of the plant during test burns, and

- upper air meteorological measurements, using minisondes, of wind, temperature, mixing height and atmospheric stability.

After the one-year intensive monitoring period and test burns, it is envisaged that a reduced monitoring program would continue for the life of the facility. It is suggested that this consist of:

- continuous monitoring of critical parameters in the incinerator flue gases (e.g., opacity, THC, CO, NO_x, HCl),

- periodic monitoring for organic compounds in ambient air using a mobile GC/MSD monitor,

- continuous monitoring of meteorological parameters at the existing monitoring station (needed primarily to support emergency response in the event of a spill or process upset), and

- continuous monitoring of "criteria" pollutants at one monitoring station to ensure that levels are consistent with regional trends and that pollutant contributions from the OWMC facility do not increase significantly.

Further, more intensive studies may be required from time to time to respond to particular concerns or in association with major changes in the design or operation of the facility, for example, if a second incinerator is added.

5.8 CONCLUSIONS

The proposed OWMC facility is to consist of a rotary kiln incinerator to handle organic wastes, and a physical/chemical treatment plant to handle inorganic wastes. Ash from the incinerator and solidified residues from the physical/chemical treatment plant are to be disposed of in a landfill. In this chapter, the effects of routine air emissions from the individual components of the OWMC facility were discussed.

Potential emissions from vehicles travelling in and out of the OWMC facility, from the incinerator stack and from the evaporator stack of the physical/chemical treatment plant, were estimated. Fugitive dust emissions were also estimated for the landfill site, incinerator ash handling and solidification plant. Fugitive chemical emissions from routine equipment leaks and spills, and from the handling and processing of waste, were also estimated. Expected emissions from the OWMC incinerator were compared to reported emissions from other combustion sources, and to measured emissions from other types of waste incineration technologies.

The effects of these air emissions on local ambient air quality were then predicted. The corresponding contaminant concentrations in ambient air in the vicinity of OWMC's preferred site were estimated by

mathematical dispersion modelling. They were compared with existing levels and with air quality standards, guidelines and criteria.

In general, it was found that emissions from the OWMC facility of all identified contaminants are well within the air quality standards, guidelines and criteria established in the Province of Ontario. Where existing concentrations are outside the desirable range, the predicted increase due to OWMC emissions would not add significantly to such concentrations.

During handling of odorous wastes, there is a possibility that some chemical compounds could be detected off-site. Comparisons made between predicted contaminant concentrations and their respective odour thresholds, showed odours to be largely limited to the OWMC site, with the potential for occasional odours beyond the site boundaries under worst-case conditions.

The visibility of the evaporator stack plume and the potential for icing and fogging were also addressed, as well as the impact of fugitive dust emissions, the main source being landfill operations.

Finally, the effects of an enlarged facility (300 000 t/a) were assessed and the emissions from the OWMC facility were discussed in relation to available international regulations and standards. Recommendations for mitigation of effects and a proposed monitoring program were outlined.

6. CONCLUSIONS AND RECOMMENDATIONS

The primary focus of this assessment of the air quality effects of the proposed OWMC facility has been compliance with the Ontario air quality standards and guidelines and other criteria, as well as a comparison with existing air quality conditions. Chapter 2 of this report provides a review of the regulatory requirements in Ontario and other jurisdictions. For Ontario, work to date has been based on existing regulations. However, these are in the process of revision by the Ontario Ministry of the Environment, with proposals for changes scheduled for publication in late 1987 or early 1988. It is expected that the OWMC facility will be required to comply with any changes in air quality regulations. Therefore, it is expected that a reassessment of the facility will be needed once the proposed changes are published.

The existing air environment at OWMC's preferred site in the Township of West Lincoln has been described in Chapter 3. Results of an on-site meteorological and air quality monitoring program conducted in 1986-1987 are presented. This is supplemented by relevant data from the literature and other observing stations in the region. A one-year data base of relevant meteorological variables has been successfully established and is used to provide site specific dispersion estimates. The air quality data collected during this monitoring study show relatively low concentrations of most air pollutants, consistent with the rural nature of the site. Only maximum levels of suspended particulate matter and ozone occasionally exceeded the criteria for desirable air quality.

Construction of the OWMC facility may generate emissions of suspended dust which have the potential to create a temporary impact on local air quality. An analysis of potential emission sources and dispersion modelling to predict off-site concentrations suggests that any nuisance effects would be limited to properties immediately adjacent to the site under the most adverse conditions for dust generation and subsequent dispersion. This confirms the experience elsewhere which indicates that impacts due to dust emissions would be infrequent, of short duration and limited to the site and its immediate vicinity. It is recommended that monitoring of construction activities be carried out to ensure that off-site dust levels are kept within acceptable limits. In addition to the normal practices to ensure dust suppression, other mitigation measures could be implemented, as required, in response to specific adverse situations.

The effects on air quality during normal operation of the OWMC facility are assessed in Chapter 5. Emission estimates have been provided for the major facility components, i.e., incinerator stack emissions, emissions from the evaporator associated with the physical/chemical treatment plant, fugitive dust emissions from the landfill and other sources, and fugitive chemical emissions from the organic unloading and storage area, and the physical/chemical treatment plant. A comparison is provided between expected emissions from the incinerator stack and other industrial sources which emit similar pollutants.

Emissions from all the above sources have been assessed to determine compliance with Ontario air quality standards and guidelines. All identified contaminants emitted from the proposed facility are predicted to be well within the allowable limits.

The steam plume from the evaporator stack has been assessed with respect to the visibility of the plume and the potential for fogging and icing on plant structures and at ground level. The assessment indicates

that the stack plume would not result in any significant fogging or icing effects. However, a visible plume of condensate would be formed under almost all conditions, typically several hundreds of metres in length. Under extreme conditions this could extend to 2 kilometres or more. Estimated frequencies of various plume lengths are given.

Dust nuisance impacts due primarily to landfill operations have been predicted. However, even under the most adverse conditions, the results show that any impacts would be limited to the immediate vicinity of the OWMC site. Such impacts as do occur are expected to be infrequent and of short duration.

Air emissions from the facility were also assessed for their potential to cause odours beyond the site boundary. The analysis showed exceedances of odour thresholds for a small number of compounds, but only under the most adverse plant operating and weather conditions. It is expected that odours would be largely limited to the OWMC property, but with the potential for occasional odours detected beyond the property boundary under the most adverse conditions. Should off-site odours occur during actual operation of the facility, measures are available to mitigate these effects.

Overall, it is predicted that the incremental effect of the facility emissions will not result in exceedances of criteria for desirable air quality. Existing concentrations which are outside the desirable range would not be exacerbated by facility emissions to any significant degree.

It is noted that the above conclusions are based on the results of a number of analyses which, in turn, were derived from a wide range of data on the construction and operation of the proposed facility. Any later refinements of these data may change certain results, although it is not expected that this would alter the fundamental conclusions of this report. It is further noted that the conclusions of this assessment,

which pertain to the reference facility design with a capacity of 150 000 t/a, would also apply generally to an expanded facility of 300 000 t/a capacity.

It has been pointed out in Chapter 5 that emissions of fugitive dust and vapours are often harder to control and predict than stack emissions. Since these emissions have the potential to cause such nuisance effects as soiling and odours at nearby receptors, it is recommended that the monitoring and assessment of fugitive emissions be part of an ongoing review of OWMC's activities. Several additional mitigation methods could be used in operation to further control both fugitive and stack emissions, if required. It is suggested that a complaint bureau be established to receive any public complaints of nuisance impacts, with the capability to respond effectively to problems as they arise.

Continued monitoring of air quality and meteorological parameters has been recommended. This includes an intensive one-year period of operational monitoring to be carried out with the primary purpose of verifying the effects of facility emissions on local air quality. Thereafter, a monitoring program for the life of the facility is recommended, which may include intensive studies from time to time to respond to particular concerns or to provide data in association with major changes in the design or operation of the facility.

To further support this assessment, the following specific recommendations for additional studies and documentation are made:

- a review of the proposed changes to the air pollution regulations in Ontario as soon as these are published, together with a reassessment of the proposed OWMC facility with respect to such changes,

- further comparison of the OWMC facility emissions with international regulations and standards, including the compilation of additional information as it becomes available,

- periodic reporting of additional monitoring data collected at the preferred site, including the program of intensive monitoring conducted in August and October, 1987, and

- a study of the effects of using alternative methods of long-term dispersion modelling, including alternative data bases to those used in this report.

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Volume

2

Final report

OWMC
Ontario
Waste Management
Corporation

A provincial crown corporation

ONTARIORESEARCH
FOUNDATION

SITE ASSESSMENT
PHASE 4B:
ATMOSPHERIC CONDITIONS
VOLUME 2 - APPENDICES A to E

Prepared for
The Ontario Waste Management Corporation

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Ontario Research Foundation

October, 1987

APPENDIX A

ONTARIO REGULATION 308
INCLUDING LISTS OF
STANDARDS AND GUIDELINES

A-1 INTRODUCTION TO APPENDIX A

Regulation 308, the component of the Environmental Protection Act that defines allowable levels of air emissions, is reproduced in this Appendix. It includes Schedule 1, the list of point-of-impingement standards. In addition to these standards, the list of ambient air quality tentative standards, guidelines and provisional guidelines is also included.

Ontario

Government
of Ontario

INTERNATIONAL YOUTH YEAR 1985

ANNÉE INTERNATIONALE DE LA JEUNESSE 1985

Environmental Protection Act

Revised Statutes of Ontario, 1980
Chapter 141
as amended by
1981, Chapter 49 and 1983, Chapter 52

and

Regulation 308
(General—Air Pollution)
Revised Regulations of Ontario, 1980
as amended by O. Reg. 107/85

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REGULATION 308

under the Environmental Protection Act

GENERAL—AIR POLLUTION

INTERPRETATION

1. In this Regulation,

(a) "air pollution episode" means an occasion when air contamination is at such a level and for such a period of time that the air contamination may become the cause of increased human sickness and mortality;

(b) "air pollution index" means a series of numbers expressing the relative levels of air pollution and taking into consideration one or more air contaminants;

(c) "equipment" includes apparatus, device, mechanism or structure;

(d) "fuel burning equipment" includes equipment designed to burn fuel but does not include an internal combustion engine;

(e) "highway" means highway as defined in subsection 1 (1) of the *Highway Traffic Act*;

(f) "incinerator" includes equipment used for the burning of waste;

(g) "opacity" means,

(i) the color of a visible emission in shades of grey to black, or

(ii) the degree to which a visible emission obstructs the passage of light;

(h) "point of emission" means the point at which a contaminant enters the natural environment;

(i) "visible emission" means any contaminant which can be detected by the naked eye. R.R.O. 1980, Reg. 308, s. 1.

APPLICATION

2. The Act and this Regulation apply to all areas within Ontario. R.R.O. 1980, Reg. 308, s. 2.

EXEMPTIONS

3. The following sources of contaminant are classes for which the approval of the Director as to the plans and specifications is not required under section 8 of the Act:

1. Fuel burning equipment used for the purpose of comfort heating in a building using natural gas or No. 2 oil at a rate of less than 1.5 million British Thermal Units per hour.

2. Equipment for the preparation of food in a domestic residence.

3. Fuel burning equipment used solely for the purpose of comfort heating in a dwelling used for the housing of not more than three families.

4. Equipment for construction or maintenance of a highway while the equipment is being used on the highway.

5. A source of visible light radiation intended for the purpose of advertising or illumination. R.R.O. 1980, Reg. 308, s. 3; O. Reg. 107/85, s. 1.

AIR POLLUTION INDEX

4.—(1) The Ministry may prepare an index to be known as the "Air Pollution Index" for any area in Ontario, from time to time.

(2) Where the air pollution index for an area indicates increasing air pollution that may lead to an air pollution episode, the Minister, in consultation with the Minister of Health, may order curtailment of the operation of sources of air pollution in the manner described in subsections (3) and (4).

(3) Where the air pollution index reaches the number 32, designated as Air Advisory Level, and meteorological forecasts indicate a six hour prolongation of atmospheric conditions conducive to sustained or increased air pollution levels, the Minister may require owners or operators of sources of air pollution to make preparation for the curtailment of such operations as are specified by the Minister.

(4) Where the air pollution index reaches the number 50, designated as First Air Pollution Alert, and meteorological forecasts indicate a six hour prolongation of atmospheric conditions conducive to sustained or increased air pollution levels, the Minister may require owners or operators of sources of air pollution to curtail such operations as are specified by the Minister. R.R.O. 1980, Reg. 308, s. 4.

CONTROL OF AIR CONTAMINANTS

5.—(1) The maximum concentration of a contaminant set out in Column 1 of Schedule 1 at a

point of impingement from a source of contaminant, other than a motor vehicle, shall not be greater than the concentration set out opposite thereto in Column 3 of Schedule 1, expressed in the unit of concentration set out opposite thereto in Column 2 of Schedule 1.

(2) The concentration of a contaminant at a point of impingement may be calculated in accordance with the Appendix.

(3) No person shall cause or permit the concentration of a contaminant at a point of impingement to exceed the standard prescribed in Schedule 1. R.R.O. 1980, Reg. 308, s. 5.

6. No person shall cause or permit to be caused the emission of any air contaminant to such extent or degree as may,

(*a*) cause discomfort to persons;

(*b*) cause loss of enjoyment of normal use of property;

(*c*) interfere with normal conduct of business; or

(*d*) cause damage to property. R.R.O. 1980, Reg. 308, s. 6.

7.—(1) The Ministry shall prepare a chart to be known as the "Visible Emission Chart of the Province of Ontario".

(2) The Visible Emission Chart of the Province of Ontario shall consist of two one-inch squares on a white background such that,

(*a*) the area within the square designated as number 1 shall have black dots or lines evenly spaced such that approximately twenty per cent of the area is black;

(*b*) the area within the square designated as number 2 shall have black dots or lines evenly spaced such that approximately forty per cent of the area is black.

(3) For the purpose of enforcing the Act and this Regulation no person other than a provincial officer who has been trained by the Ministry in the identification of opacity shall determine the opacity of a visible emission. R.R.O. 1980, Reg. 308, s. 7.

8.—(1) Subject to subsection (2), no person shall cause or permit to be caused a visible emission,

(*a*) having shades of grey darker than number 1 on the Visible Emission Chart of the Province of Ontario at the point of emission; or

(*b*) that obstructs the passage of light to a degree greater than twenty per cent at the point of emission.

(2) A visible emission from a source of combustion employing solid fuel may,

(*a*) be in shades of grey darker than number 1, but not darker than number 2 on the Visible Emission Chart of the Province of Ontario at the point of emission; or

(*b*) obstruct the passage of light to a degree greater than 20 per cent but no greater than 40 per cent at the point of emission,

for a period of not more than four minutes in the aggregate in any thirty-minute period. R.R.O. 1980, Reg. 308, s. 8.

9. Where at any stationary source of air pollution a failure to operate in the normal manner or a change in operating conditions occurs, or a shut-down of the source or part thereof is made for some purpose, resulting in the emission of air contaminants that may result in quantities or concentrations in excess of those allowed in sections 5, 6 and 8,

(*a*) the owner or operator of the source of air pollution shall,

(i) immediately notify a provincial officer and furnish him with particulars of such failure, change or shut-down, and

(ii) furnish the provincial officer with the particulars in writing, as soon as is practicable, of such failure, change or shut-down; and

(*b*) the provincial officer, where he considers it advisable, may authorize, in writing, the continuance of such operation for such period of time as he considers reasonable in the circumstances and may impose upon the owner or operator such terms and conditions for such continued operation as he considers necessary in the circumstances. R.R.O. 1980, Reg. 308, s. 9

10.—(1) No person shall burn or permit to be burned in any fuel burning equipment or incinerator any fuel or waste except the fuel or waste for the burning of which the equipment or incinerator was designed.

(2) No person shall burn or permit to be burned in any fuel burning equipment or incinerator any fuel or waste at a greater rate than that rate for which the equipment or incinerator was designed. R.R.O. 1980, Reg. 308, s. 10.

11. Except for heat, sound, vibration or radiation, no person shall,

(*a*) construct, alter, demolish, drill, blast, crush or screen anything or cause or permit the construction, alteration, demolition, drilling, blasting, crushing or screening of anything so that a contaminant is carried beyond the limits of the property on which the construction, alteration, demolition, drilling, blasting, crushing or screening is being carried out; or

(*b*) sandblast or permit the sandblasting of anything so that a contaminant is emitted into the air,

to an extent or degree greater than that which would result if every step necessary to control the emission of the contaminant were implemented. R.R.O. 1980, Reg. 308, s. 11.

12.—(1) No person shall operate or permit the operation of,

(*a*) an apartment incinerator, domestic incinerator, multiple chamber incinerator or starved air incinerator burning domestic waste;

(*b*) a multiple chamber incinerator or a starved air incinerator burning solid industrial waste;

(*c*) an incinerator burning liquid industrial waste, industrial slurries or sludges, sewage sludges or slurries, gaseous waste, organic vapour or fume; or

(*d*) a municipal incinerator burning solid waste or sludges,

that causes or is likely to cause a concentration in the combustion gases emitted into the natural environment, of organic matter having a carbon content, expressed as equivalent methane, being an average of ten measurements taken at approximately one minute intervals, greater than 100 parts per million by volume, measured on an undiluted basis.

(2) Subsection (1) does not apply to prohibit the operation of a catalytic incinerator. R.R.O. 1980, Reg. 308, s. 12.

13. No person shall store, handle or transport any solid, liquid or gaseous material or substance in such manner that an air contaminant is released to the atmosphere. R.R.O. 1980, Reg. 308, s. 13.

Schedule 1

Item	Column 1	Column 2	Column 3
	Name of Contaminant	Unit of Concentration	Concentration at Point of Impingement—Half Hour Average
1.	Acetic Acid	Micrograms of acetic acid per cubic metre of air	2,500
2.	Acetylene	Micrograms of acetylene per cubic metre of air	56,000
3.	Acetone	Micrograms of acetone per cubic metre of air	48,000
4.	Acrylamide	Micrograms of acrylamide per cubic metre of air	45
5.	Acrylonitrile	Micrograms of acrylonitrile per cubic metre of air	2,200
6.	Ammonia	Micrograms of ammonia per cubic metre of air	3,600
7.	Antimony	Total micrograms of antimony in free and combined form per cubic metre of air	75
8.	Arsenic	Total micrograms of arsenic in free and combined form per cubic metre of air	75
9.	Arsine	Micrograms of arsine per cubic metre of air	10
10.	Benzene	Micrograms of benzene per cubic metre of air	10,000
11.	Beryllium	Total micrograms of beryllium in free and combined form per cubic metre of air	0.03
12.	Boron Tribromide	Micrograms of boron tribromide per cubic metre of air	100
13.	Boron Trichloride	Micrograms of boron trichloride per cubic metre of air	100
14.	Boron Trifluoride	Micrograms of boron trifluoride per cubic metre of air	5.0
15.	Boron	Total micrograms of boron in free and combined form per cubic metre of air	100
16.	Bromine	Micrograms of bromine per cubic metre of air	70
17.	Cadmium	Total micrograms of cadmium in free and combined form per cubic metre of air	5.0

Item	Column 1 Name of Contaminant	Column 2 Unit of Concentration	Column 3 Concentration at Point of Impingement—Half Hour Average
18.	Calcium Hydroxide	Micrograms of calcium hydroxide per cubic metre of air	27
19.	Calcium Oxide	Micrograms of calcium oxide per cubic metre of air	20
20.	Carbon Black	Micrograms of carbon black per cubic metre of air	25
21.	Carbon Disulphide	Micrograms of carbon disulphide per cubic metre of air	330
22.	Carbon Monoxide	Micrograms of carbon monoxide per cubic metre of air	6,000
23.	Carbon Tetrachloride	Micrograms of carbon tetrachloride per cubic metre of air	20,000
24.	Chlorine	Micrograms of chlorine per cubic metre of air	300
25.	Chlorine Dioxide	Micrograms of chlorine dioxide per cubic metre of air	85
26.	Chromium	Total micrograms of chromium in free and combined form per cubic metre of air	30
27.	Copper	Total micrograms of copper in free and combined form per cubic metre of air	100
28.	Cresols	Micrograms of cresols per cubic metre of air	230
29.	Decaborane	Micrograms of decaborane per cubic metre of air	50
30.	Detergent Enzyme (Subtilisin)	Micrograms of subtilisin per cubic metre of air	1.0
31.	Diborane	Micrograms of diborane per cubic metre of air	20
32.	Dicapryl Phthalate	Micrograms of dicapryl phthalate per cubic metre of air	100
33.	Dimethyl Disulphide	Micrograms of dimethyl disulphide per cubic metre of air	40
34.	Dimethyl Sulphide	Micrograms of dimethyl sulphide per cubic metre of air	30
35.	Dioctyl Phthalate	Micrograms of dioctyl phthalate per cubic metre of air	100
36.	Dustfall	Micrograms per square metre	8,000

Item	Column 1	Column 2	Column 3
	Name of Contaminant	Unit of Concentration	Concentration at Point of Impingement—Half Hour Average
37.	Ethyl Acetate	Micrograms of ethyl acetate per cubic metre of air	19,000
38.	Ethyl Acrylate	Micrograms of ethyl acrylate per cubic metre of air	4.5
39.	Ethyl Benzene	Micrograms of ethyl benzene per cubic metre of air	4,000
40.	Ethylene Oxide	Micrograms of ethylene oxide per cubic metre of air	28,500
41.	Ferric Oxide	Micrograms of ferric oxide per cubic metre of air	75
42.	Fluorides, (Gaseous) (April 15 to October 15)	Micrograms of gaseous, inorganic fluoride per cubic metre of air expressed as hydrogen fluoride	4.3
43.	Fluorides, (Total) (April 15 to October 15)	Total micrograms of inorganic fluoride per cubic metre of air expressed as hydrogen fluoride	8.6
44.	Fluorides, (Total) (October 16 to April 14)	Total micrograms of inorganic fluoride per cubic metre of air expressed as hydrogen fluoride	17.2
45.	Formaldehyde	Micrograms of formaldehyde per cubic metre of air	65
46.	Formic Acid	Micrograms of formic acid per cubic metre of air	1,500
47.	Furfural	Micrograms of furfural per cubic metre of air	1,000
48.	Furfuryl Alcohol	Micrograms of furfuryl alcohol per cubic metre of air	3,000
49.	Hydrogen Chloride	Micrograms of hydrogen chloride per cubic metre	100
50.	Hydrogen Cyanide	Micrograms of hydrogen cyanide per cubic metre of air	1,150
51.	Hydrogen Sulphide	Micrograms of hydrogen sulphide per cubic metre of air	30
52.	Iron (metallic)	Micrograms of metallic iron per cubic metre of air	10
53.	Lead	Total micrograms of lead in free and combined form per cubic metre of air	10
54.	Lithium Hydrides	Total micrograms of lithium hydrides per cubic metre of air	7.5

Item	Column 1	Column 2	Column 3
	Name of Contaminant	Unit of Concentration	Concentration at Point of Impingement—Half Hour Average
55.	Lithium	Total micrograms of lithium in other than hydride compounds per cubic metre of air	60
56.	Magnesium Oxide	Total micrograms of magnesium oxide per cubic metre of air	100
57.	Manganese	Total micrograms of manganese in free and combined form per cubic metre of air	100
58.	Mercaptans	Total micrograms of mercaptans per cubic metre of air expressed as methyl mercaptans	20
59.	Mercury (alkyl)	Total micrograms of alkyl mercury compounds per cubic metre of air	1.5
60.	Mercury	Total micrograms of mercury in free and combined form per cubic metre of air	5.0
61.	Methyl Acrylate	Micrograms of methyl acrylate per cubic metre of air	4.0
62.	Methyl Alcohol	Micrograms of methyl alcohol per cubic metre of air	84,000
63.	Methyl Bromide	Micrograms of methyl bromide per cubic metre of air	12,000
64.	Methylene Chloride	Micrograms of methylene chloride per cubic metre of air	100,000
65.	Methyl Chloroform (1-1-1 Trichloroethane)	Micrograms of methyl chloroform per cubic metre of air	350,000
66.	Methyl Ethyl Ketone (2-Butanone)	Micrograms of methyl ethyl ketone per cubic metre of air	31,000
67.	Methyl Methacrylate	Micrograms of methyl methacrylate per cubic metre of air	860
68.	Milk Powder	Micrograms of milk powder per cubic metre of air	20
69.	Monomethyl Amine	Micrograms of monomethyl amine per cubic metre of air	25
70.	Nickel	Total micrograms of nickel in free and combined form per cubic metre of air	5
71.	Nickel Carbonyl	Micrograms of nickel carbonyl per cubic metre of air	1.5
72.	Nitric Acid	Micrograms of nitric acid per cubic metre of air	100

Item	Column 1	Column 2	Column 3
	Name of Contaminant	Unit of Concentration	Concentration at Point of Impingement Half Hour Average
73.	Nitrilotriacetic Acid	Micrograms of Nitrilotriacetic Acid per cubic metre of air	100
74.	Nitrogen Oxides	Micrograms of nitrogen oxides per cubic metre of air expressed as NO_2	500
75.	Ozone	Micrograms of ozone per cubic metre of air	200
76.	Pentaborane	Micrograms of pentaborane per cubic metre of air	3.0
77.	Pentachlorophenol	Micrograms of pentachlorophenol per cubic metre of air	90
78.	Phenol	Micrograms of phenol per cubic metre of air	100
79.	Phosgene	Micrograms of phosgene per cubic metre of air	130
80.	Phosphoric Acids	Micrograms of phosphoric acids per cubic metre of air expressed as P_2O_5	100
81.	Phthalic Anhydride	Micrograms of phthalic anhydride per cubic metre of air	100
82.	Propylene Dichloride	Micrograms of propylene dichloride per cubic metre of air	2,400
83.	Propylene Oxide	Micrograms of propylene oxide per cubic metre of air	78,000
84.	Silver	Total micrograms of silver in free and combined form per cubic metre of air	3
85.	Styrene	Micrograms of styrene per cubic metre of air	400
86.	Sulphur Dioxide	Micrograms of sulphur dioxide per cubic metre of air	830
87.	Sulphuric Acid	Micrograms of sulphuric acid per cubic metre of air	100
88.	Suspended Particulate Matter (particulate less than 44 microns in size)	Total micrograms of suspended particulate matter per cubic metre of air	100
89.	Tellurium (except hydrogen telluride)	Micrograms of tellurium in free and combined form per cubic metre of air	30
90	Tetrahydrofuran	Micrograms of tetrahydrofuran per cubic metre of air	93,000
91.	Tin	Total micrograms of tin in free and combined form per cubic metre of air	30

Item	Column 1	Column 2	Column 3
	Name of Contaminant	Unit of Concentration	Concentration at Point of Impingement—Half Hour Average
92.	Titanium	Total micrograms of titanium in free and combined form per cubic metre of air	100
93.	Toluene	Micrograms of toluene per cubic metre of air	2,000
94.	Toluene Di-isocyanate	Micrograms of toluene di-isocyanate per cubic metre of air	1.0
95.	Trichloroethylene	Micrograms of trichloroethylene per cubic metre of air	85,000
96.	Trifluorotrichloro Ethane	Micrograms of trifluoro trichloroethane per cubic metre of air	2.4 million
97.	Vanadium	Total micrograms of vanadium in free and combined form per cubic metre of air	5.0
98.	Vinylidene chloride (1, 1 Dichloro Ethene)	Micrograms of vinylidene chloride per cubic metre of air	26,000
99.	Xylenes	Micrograms of xylenes per cubic metre of air	2,300
100.	Zinc	Total micrograms of zinc in free and combined form per cubic metre of air	100

R.R.O. 1980, Reg. 308, Sched. 1

List of Ambient Air Quality Criteria, Standards, Tentative Design Standards, Guidelines, and Provisional Guidelines as of 9,March 1987

Contaminant	POI .5h Av	AAQC 24h Av	LE	ST
Acetic Acid	2500	2500	O	S
Acetylene	56000	56000	O	S
Acetone	48000	48000	O	S
Acrylamide	45	15	H	S
Acrylonitrile *	2200	750	H	S
Acrylonitrile	300	100	H	TS
n-alkyltoluene sulphonamide	100	120	T	PG
Alpha Naphthol	100	100	H	G
Aluminum Oxide	100	120	T	PG
Ammonia	3600	3600	O	S
Ammonium chloride	100	100	T	PG
Antimony	75	25	H	S
Arsenic *	75	25	H	S
Arsenic *	15	5	H	TS
Arsenic	1	.3	H	PG
Arsine	10	5	H	S
Asbestos	5 #	0.04 9	H	G
Barium-total water soluble	30	10	H	G
Benzene	10000	3300	H	S
Benzo(a)pyrene	3.3 16 ss	0.3 16,6 as 1.1 16,ss	H	PG

		0.22	16,6,ss		
Benzothiazole	200	70		H	PG
Benzoyl Chloride	350	125		C,H	PG
Beryllium	0.03	0.01		H	S
Biphenyl	60	60	1	O	G
Boron Tribromide	100	35		C	S
Boron Trichloride	100	35		C	S
Boron Trifluoride	5	2		V	S
Boron	100	100		T	S
Bromacil	30	10		H	G
Bromine	70	20		H	S
n-Butyl Acetate*	15000	15000		I	PG
n-Butyl Acetate		15000	1	H	PG
	735	1000	18	O	PG
		248		O	PG
		47	6	O	PG
Butyl Acrylate	100	100		T	G
Butyl Stearate	100	14000		T	G
Cadmium	5	2		H	S
Calcium Carbide	20	10		W	PG
Calcium Cyanide ôô	100	100		T	PG
Calcium Hydroxide	27	13.5		C	S
Calcium Oxide	20	10		C	S
Captan	75	25		H	PG
Carbon Black	25	10		S	S
Carbon Disulphide	330	330		O	S
Carbon Monoxide	6000	36200	1	H	S
		15700	2	Z	S
Carbon Tetrachloride	20000	7000		H	S

Carbon Tetrachloride	1800	600	H	G
Cellosolve Acetate	100	5000	T	G
Chloramben	100	120	T	PG
Chlordane	15	5	H	G
Chlorinated Dibenzo Dioxins, CDDs	450 17	30 17,6	H	PG
Mixtures of Chlorinated Dibenzo Dioxins and Chlorinated Dibenzo Furans, CDFs				
x/450pg + y/450(50)pg = 1	x/30pg + y/30(50)pg =1 (annual average)		H	PG
x=concentration (pg/m) of CDDs in air				
y=concentration (pg/m) of CDFs in air pg=picogram=10-12g.				
Chlorine	300	150	H,V	S
Chlorine Dioxide	85	30	H	S
Chloroform	1500	500	H	G
Chromium *	30	10	H	S
Chromium (Di, Tri, and Hexavalent forms)	5	1.5	H	PG
Coal Pitch Volatiles	3	1	H	PG
(soluble fraction)		0.2 6		PG
Copper	100	50	H	S
Cresols	230	75	H	S
Cyclo Sol 63	25000	5000	H	PG
Cyclohexane	300000	100000	H	G
Decaborane	50	25	H	S
Decene-1	180000	60000	H	PG
Detergent Enzyme * (Subtilisin)	1	0.3	H	S

Detergent Enzyme	0.20	0.06		H	TS
Diazinon	9	3		H	G
Diborane	20	10		H	S
Dibutyltin Dilaurate	100	30		H	G
Dicapryl Phthalate	100	500		T	S
Diisobutyl Ketone		3500		H	PG
	470	649	18	O	PG
		159		O	PG
		30	6	O	PG
Difluorodichloromethane (Freon 12)	1.5M	500000		H	G
Dimethyl Disulphide	40	40	1	O	S
Dimethyl Ether	2100	2100		O	G
Dimethyl Sulphide	30	30	1	O	S
Dioctyl Phthalate	100	500		T	S
Dodecyl Benzene Sulphonic Acid	100	100		T	PG
Droperidol	3	1		H	PG
Dustfall	8000 a	7.0	3,4	S	S
Ethyl Acetate	19000	19000	1	O	S
Ethyl Acrylate	4.5	4.5	1	O	S
Ethyl Alcohol	19000	19000	1	O	G
Ethyl Benzene	4000	4000	1	O	S
Ethyl Ether	30000	30000		O,H	TS
Ethyl-3-ethoxy propionate	147	200	18	O	PG
		50		O	PG
		6500		H	PG
		9.5	6	O	PG
2-Ethyl Hexanol	600	600	1	O	G

2-Ethylanthraquinone	30	10		H	PG
Ethylene	160	40		V	TS
Ethylene Dichloride	1200	400		H	PG
Ethylene Glycol Dinitrate	10	3		H	G
Ethylene Glycol Butyl Ether		2400		H	PG
(Butyl Cellosolve)	350	500	18	O	PG
Ethylene Glycol		3250		H	PG
Butyl Ether Acetate	500	700	18	O	PG
(Butyl Cellosolve Acetate)					
Ethylene Glycol		380		H	PG
Ethyl Ether	800	1100	18	O	PG
(Cellosolve)					
Ethylene Glycol		540		H	PG
Ethyl Ether Acetate	220	300	18	O	PG
(Cellosolve Acetate)					
Ethylene Oxide *	28500	9500		H	S
Ethylene Oxide	15	5		H	PG
Ethylenediaminetetra-	100	120		T	PG
acetic Acid					
Fentanyl Citrate	0.06	0.02		H	PG
Ferric Oxide	75	25		S	S
Fluoridation T,GS		40	4,15	V	G
Fluoridation T,NM		80	4,15	V	G
Fluorides G,%%,AO	4.3	0.86		V	S
		0.34	4		S
Fluorides G,P,%%,AO	8.6	1.72		V	S
		0.68	4		S
Fluorides G,P,%% NM	17.2	3.44		V	S
		1.38	4		S

Fluorides in forage	-	80	11,12	A	G
Fluorides in forage		60	11,13	A	G
Fluorides in forage !		35	11,14	A	G
Fluorinert 3M-FC-70	100	100		T	PG
Formaldehyde	65	65	1	O	S
Formic Acid	1500	500		H	S
Furfural	1000	1000	1	O	S
Furfuryl Alcohol	3000	1000		H	S
Glutaraldehyde	42	14		H	PG
		35	1		
Haloperidol	3	1		H	PG
Hexachlorocyclopentadiene	6	2		H	PG
Hexamethyl Disilazane	5	2		H	PG
Hexamethylene Diisocyanate Monomer	1.5	0.5		H	PG
Hexamethylene Diisocyanate Trimer	3	1		H	PG
Hexane	35000	12000		H	G
Hydrogen Chloride	100	40		C	S
Hydrogen Cyanide	1150	575		H	S
Hydrogen Peroxide	90	30		H	PG
Hydrogen Sulphide	30	30	1	O	S
Isobutanol	1940	2640	18	O	PG
		655		O	PG
		15000	1	H	PG
		125	6	O	PG
Isobutyl Acetate	1220	1660	18	O	PG
		412		O	PG
		12700		H	PG

		79	6	O	PG
Isopropyl Acetate	1470	2000	18	O	PG
		500		O	PG
		19000		H	PG
		95	6	O	PG
Iron (Metallic)	10	4		S	S
Isopropyl Alcohol	24000	24000		O	G
Isopropyl Benzene	100	100	1	O	PG
Lead	10	3	4,5	H	S
		2	4,7	H	TS
		5	8	H	TS
Lead in Dustfall	0.1 3.4	-		H	G
Lindane (Hexachloro-cyclohexane)	15	5		H	PG
Lithium Hydrides	7.5	2.5		H	S
Lithium (other than hydrides)	60	20		H	S
Manganese Compounds	30	10		H	PG
Magnesium Oxide	100	100		T	S
Malathion	100	300		T	G
Maleic Anhydride	100	30		H	G
Manganese	100	50		T	S
Mercaptans (as methyl mercaptan)	20	20	1	O	S
Mercapto benzo thiazo disulphide	100	100		T	G
Mercury (alkyl)	1.5	0.5		H	S
Mercury	5	2		H	S
Metaldehyde	100	120		T	PG

Methacrylic Acid	2000	2000	O	G
Methane diphenyl di-isocyanate	3	1	H	TS
Methoxychlor	100	100	T	G
5-methyl-2-hexanone	460	630 18	O	PG
		160	O	PG
		4600	H	PG
		30 6	O	PG
Methyl Acrylate	4	4 1	O	S
Methyl Alcohol	84000	28000	H	S
Methyl Bromide *	12000	4000	H	S
Methyl Bromide	4000	1350	H	G
Methyl Chloride	20000	7000	H	G
Methyl Chloroform (1-1-1 Trichloroethane)	350000	115000	H	S
Methyl Ethyl Ketone (2-Butanone)	31000	31000 1	O	S
Methyl Ethyl Ketone Peroxide	250	80	H	G
		200 1		G
Methyl Isobutyl Ketone	1200	1200	O	G
Methyl Methacrylate	860	860	O	S
Methyl-N-Amyl Ketone **				G
Methyl Salicylate	300	100	H	G
4,4 Methylene-Bis-2-Chloroaniline	30	10	H	G
Methylene Chloride	100000	100000 1	O	S
Methylene Dianiline	30	10	H	G
Miconazole Nitrate	15	5	H	PG

Milk Powder	20	20	S,O	S
Monomethyl Amine	25	25	O	S
Nickel	5	2	V	S
Nickel Carbonyl	1.5	.5	H	S
Nitric Acid	100	35	C	S
Nitrilotriacetic Acid	100	100	T	S
Nitroglycerin	10	3	H	G
Nitrogen Oxides (as NO2)	500	200	H	S
Nitrous Oxide	27000	9000	H	PG
Octane	45400	61800	O	PG
		15300	O	PG
		145000	H	PG
		2900 6	O	PG
Octene-1	150000	50000	H	PG
Oxalic Acid	75	25	H	PG
Ozone	200	165 1	H,V	S
Palladium (H2O sol.) ##	30	10	H	PG
Penicillin	0.3	0.1	H	G
Pentaborane	3	1	H	S
Pentachlorophenol *	90	30	H,V	S
Pentachlorophenol	60	20	H	G
Perchloroethylene	10000	4000	H	G
Phenol	100	100	O	S
Phosgene	130	45	H	S
Phosphine	30	10	H	PG
Phosphoric Acid (as P2O5)	100	100	H,T	S
Phosphorus Pentachloride	30	10	H	G

Phosphorus Oxychloride	40		12		H	PG
Phthalic Anhydride	100		100		T	S
Pimozide	0.3		0.1		H	PG
Platinum in water soluble compounds %	0.6		0.2		H	G
Polybutene-1-Sulphone	100		100		T	PG
Polychlorinated	450	16	150	16	H	G
Biphenyls (risk: .84/m)			35	16,6,10		G
Polychloroprene	100		500		T	G
Potassium Cyanide ∂∂	100		100		T	PG
Propionic Acid	100		100	1	O	G
Propionic Anhydride (exressed as propionic acid)	100		100	1	O	G
n-Propyl Alcohol	48000		16000		H	G
Propylene Dichloride	2400		2400		O	S
Propylene Glycol Mono-methyl Ether Acetate	5000		5000		O	PG
Propylene Glycol Methyl	89000		121000	18	O	PG
Ether			30000		O	PG
			5700	6	O	PG
Propylene Oxide*	78000		26000		H	S
Propylene Oxide	100		4500		H	PG
Pyridine			150		H	PG
	60		80	18	O	PG
Selenium	20		10		H	G
Silane	450		150		H	PG
Silica-respirable (d<10 um)	15		5		H	G
Silver	3		1		H	S

Sodium Chlorite	60	20		H	PG
Sodium Cyanide @@	100	100		T	PG
Sodium Hydroxide	20	10		C	PG
Solvesso 100		1250		H	PG
	1250	1700	18	O	PG
		422		O	PG
		80	6	O	PG
Solvesso 150		2750		H	PG
	1250	1700	18	O	PG
		422		O	PG
		80	6	O	PG
Stannous Chloride (as Tin)	30	10		H	PG
Styrene	400	400		O	S
Sulphation	0.04 19			X	G
Sulphur Dioxide	830	275		H	S
		690	1	V	S
		55	6	T	S
Sulphuric Acid	100	35		C	S
Suspended Particulate	100	120		H	S
Matter (d<44 um)		60	6,7		S
Talc (fibrous)	5	2		H	G
Tellurium (except	30	10		H	S
hydrogen telluride)					
Tetrabutylurea	30	10		H	PG
Tetrahydrofuran	93000	93000		O	S
Tetramethyl thiuram	30	10		H	G
disulphide					
Thiourea	60	20		H	PG
Tin	30	10		H	S

Titanium	100	100	T	S
Tolmetin Sodium	15	5	H	PG
Toluene	2000	2000	O	S
Toluene Di-isocyanate	1	0.5	H	S
Total Reduced Sulphur (TRS) as equivalent H_2S (from Kraft Pulp Mills)	40	40 1	O	PG
1,2,4-Trichlorobenzene	100	400	T	G
Trichloroethylene	85000	28000	H	S
Trifluorotrichloro Ethane	2.4M	800000	H	S
Trimethyl Amine	0.5	0.5 1	O	G
1,2,4-Trimethylbenzene	100	1000	T	G
Tripropyltin Methacrylate	3	1		G
Vanadium	5	2	H	S
Vinyl Chloride	560	280	H	G
Vinylidene Chloride * (1,1-Dichloro Ethene)	26000	8600	H	S
Vinylidine Chloride	70	35	H	PG
Whey Powder	100		T	PG
Xylenes	2300	2300	O	S
Zinc	100	100	T	S

DEFINITIONS FOR ABBREVIATIONS IN LIST OF STANDARDS, TENTATIVE STANDARDS, GUIDELINES, AND PROVISIONAL GUIDELINES

A - Effects on Animals
C - Corrosion
G - Gaseous
H - Health
I - Irritant property
M - Million
O - Odour
P - Particulate
S - Soiling
as - All Sources
ss - Single Source
t - Total
T - TSP (total suspended particulate) standard
V - Vegetation
W - Corrosivity of reaction product with water
X - SO2 activity
Z - High background levels from automobiles

AO - April 1 - October 31
GS - Growing season
May 1 - September 30 - NE & NW regions
April 1 - October 31 - other regions
NM - November 1 - March 31

! - Criterion
!! - Including Potassium Permanganate as Manganese
@ - ug/m2
@@ - As total salt
# - Total Asbestos
- Water soluble forms including Palladium Chloride as Palladium
% - Including Hexachloroplatinic Acid as Platinium
%% - As HF
* - changed
** - under review, for details see contact

1 - 1 hour
2 - 8 hour
3 - g/m2
4 - 30 day
5 - arithmetic mean
6 - 1 year
7 - geometric mean
8 - single sample
9 - fibres of length > 5um
10 - average
11 - ppm
12 - dry weight, any single month
13 - dry weight, average of 2 consecutive monthes
14 - dry weight, average of monthly results for growing season
15 - ug/cm2
16 - ng/m
17 - pg/m
18 - 10 minute
19 - mg SO3/100 cm2/day

POI - Point of Impingement - ug/m

AACQ - Ambient Air Quality Criterion - ug/m
LE - Limiting Effect
ST - Type of Standard :
S - Standard
TS - Tentaive Design Standard
G - Guideline
PG - Provisional Guideline

a - average
a.m. - arithmetic mean
cm - cubic centimetre
cm2 - square centimetre
d - days
g - gram
g.m. - geometric mean
h - hour
m - cubic metre
mg - milligram - 10-3 g
m2 - square metre
n - nanogram - 10-9 g
pg - picogram - 10-12 g
ppm - parts per million
ug - microgram - 10-6 g
um - micrometre
y - year

fluoridation is measured by exposing a 100 cm2 limed filter paper for 30d

contact: Emission Technology and Regulation Development Section
Air Resources Branch
Ontario Ministry of the Environment
416-965-5776

APPENDIX B

ONTARIO REGULATION 308 DISPERSION MODEL

B-1 INTRODUCTION TO APPENDIX B

This appendix contains the dispersion model and prescribed calculations as defined by Regulation 308 under the Environmental Protection Act.

Appendix

1. In this Appendix, wherever the height of a building or structure is referred to, there shall not be included in calculating such height the height of any flagpole, aerial or stack designed for venting emissions.

2. The concentration of a contaminant at a point of impingement shall be calculated as follows

(*a*) where the point of impingement is located on the building or structure or is within five metres horizontally of the building or structure on which the point of emission is located, and,

(i) the height above grade at the point of emission is less than twice the height of the highest part of the building or structure on which the point of emission is located where the highest part of the building or structure is at a height of not more than twenty metres above grade.
(*see figures 1 and 2*)

(ii) the height of the highest part of the building or structure on which the point of emission is located is greater than twenty metres above grade and the point of emission is less than twenty metres above the highest part of the building or structure on which it is located, or
(*see figure 3*)

(iii) there is a building or structure upwind from the point of emission such that,

a. the height above grade of the building or structure is greater than the height above grade at the point of emission, and

b. the building or structure is a horizontal distance of 100 metres or less from the point of emission.
(*see figures 4 and 5*)

the following formula shall be applied
(*see notes 1 and 2*)

$$K = \frac{0.6 \times 10^8 \times Q}{L^2}$$

Where K is the half hour average concentration at the point of impingement in micrograms per cubic metre,

Q is the rate of emission in grams per second of the contaminant,

L is,

(i) where the point of impingement is at the same height or higher above grade than the point of emission, the straight line distance in metres between the point of emission and the point of impingement, or

(ii) where the point of impingement is lower in height above grade than the point of emission, the product of 1.57 and the straight line distance in metres between the point of emission and the point of impingement

NOTES 1. Where a building or structure adjacent to the building or structure on which the point of emission is located is within five metres of that building or structure, it shall be treated as being part of the building or structure on which the point of emission is located.

2. Where K yields a value greater than the concentration of the contaminant at the point of emission, the concentration of the contaminant at the point of emission shall be deemed to be the value of K.

(*b*) where the point of impingement is a horizontal distance of five metres or more from the building or structure on which the point of emission is located and,

(i) the height above grade at the point of emission is less than twice the height of the highest part of the building or structure on which the point of emission is located where the highest part of the building or structure is at a height of not more than twenty metres above grade.
(*see figures 6 and 7*)

(ii) the height of the highest part of the building or structure on which the point of emission is located is greater than twenty metres above grade and the point of emission is less than twenty metres above the highest part of the building or structure on which it is located, or
(*see figure 8*)

(iii) there is a building or structure upwind from the point of emission such that,

1. the height above grade of the building or structure is greater than the height above grade at the point of emission, and

2. the building or structure is a horizontal distance of 100 metres or less from the point of emission.
(*see figures 9 and 10*)

the following formula shall be applied:
(*see notes 1 and 3*)

$$K = \frac{10^6 \times Q \times F}{31.4 \times \sigma_y \times \sigma_z} \times \exp\left[-\frac{1}{2}\left(\frac{Y}{\sigma_y}\right)^2\right] \cdot \left\{ \exp\left[-\frac{1}{2}\left(\frac{Z-H}{\sigma_z}\right)^2\right] - \exp\left[-\frac{1}{2}\left(\frac{Z-H}{\sigma_z}\right)^2\right]\right\}$$

Where: K is the half hour average concentration of the contaminant at the point of impingement in micrograms per cubic metre

Q is the rate of emission in grams per second of the contaminant
(*see note 2*)

exp is the exponential function where e = 2.7183

Y is the perpendicular distance in metres between the point of impingement and a vertical plane parallel to the chosen direction of the wind through the wind-oriented centre of the building or structure on which the point of emission is located
(*see figures 11 and 12*)
(*see notes 4 and 5*)

Z is the difference in height, in metres, between the point of impingement and the ground level at or beneath the point of impingement

H is a function of the height, in metres, above grade of the building or structure on which the point of emission is located

F is a factor related to the atmospheric stability of the air

σ_y is a function which defines the amount of dispersion of the contaminant in a horizontal direction at the point of impingement

σ_z is a function which defines the amount of dispersion of the contaminant in a vertical direction at the point of impingement

Determination of K 1. Two values for K shall be determined using the formula in clause (*b*).

2. The maximum value obtained for K shall be applied in this Regulation.

Value number 1 for K is determined as follows:

H is 0.67 times the height, in metres, above grade of the building or structure on which the point of emission is located

F is 0.6

σ_y is determined as follows:

$\sigma'_y = \frac{A}{4.3}$ where A is the greatest width, in metres, presented to the wind by the building or structure on which the point of emission is located, measured horizontally and perpendicularly to the direction of the wind
(*see figure 13*)

where σ'_y is equal to or less than 243.45

calculate $X'_y = 6.554\ \sigma'^{1.08172}_y$

where σ'_y is greater than 243.45

calculate $X'_y = 4.524\ \sigma'^{1.14616}_y$

and calculate

$X_y = G - X'_y$ where G is the horizontal distance, in metres, between the wind-oriented centre of the building or structure on which the point of emission is located and the line where vertical planes, one through the wind-oriented centre of the building or structure on which the point of emission is located and parallel to the chosen direction of the wind, and the other through the point of impingement, meet at right angles
(*see figure 14*)
(*see note 6*)

where the value of X_y is equal to or less than 2500

calculate $\sigma_y = 0.176\ X_y^{0.92445}$

where the value of X_y is greater than 2500

calculate $\sigma_y = 0.268\ X_y^{0.87248}$

σ_z is determined as follows

$\sigma'_z = \frac{B}{2.15}$ where B is the height above ground in metres of the highest part of the building or structure on which the point of emission is located

where σ'_z is equal to or less than 141.41

calculate $X'_z = 12.027\ \sigma'^{1.08783}_z$

where σ'_z is greater than 141.41

calculate $X'_z = 10.418\ \sigma'^{1.10419}_z$

and calculate $X_z = G - X'_z$ where G has the same value for G as used in the equation

$X_y = G - X'_y$

Where the value of X_z is equal to or less than 2500

calculate $\sigma_z = 0.106\ X_z^{0.91926}$

where X_z is greater than 2500

calculate $\sigma_z = 0.120\ X_z^{0.90564}$

Value number 2 for K is determined as follows:

Where: H is 0.67 times the height in metres above grade of the building or structure on which the point of emission is located

F is 0.8

σ_y is determined as follows:

$\sigma'_y = \frac{A}{4.3}$ where σ'_y has the same value as σ'_y determined for value number 1 for K

where σ'_y is equal to or less than 49.01

calculate $X'_Y = 10.686\ \sigma'^{1.07455}_y$

where σ'_y is greater than 49.01 and less than 409.32

calculate $X'_Y = 10.020\ \sigma'^{1.08889}_y$

where σ'_y is equal to or greater than 409.32

calculate $X'_Y = 6.760\ \sigma'^{1.15556}_y$

and calculate

$X_Y = G + X'_Y$ where G has the same value for G determined for value number 1 for K

where the value of X_Y is equal to or less than 700

calculate $\sigma_y = 0.110\ X_Y^{0.93062}$

where X_Y is greater than 700 and less than 7000

calculate $\sigma_y = 0.120\ X_Y^{0.91837}$

where X_Y is equal to or greater than 7000

calculate $\sigma_y = 0.191\ X_Y^{0.86538}$

σ_z is determined as follows.

$\sigma'_z = \frac{B}{2.15}$ where B is the vertical height above grade of the highest part of the building or structure on which the point of emission is located

where σ'_z is equal to or less than 24.64

calculate $X'_Z = 16.524\ \sigma'^{1.16918}_z$

where σ'_z is greater than 24.64 and less than 110.75

calculate $X'_Z = 4.984\ \sigma'^{1.53965}_z$

where σ'_z is equal to or greater than 110.75

calculate $X'_Z = 1.090\ \sigma'^{1.85677}_z$

and calculate

$X_Z = G + X'_Z$ where G has the same value for G determined for value number 1 for K

where X_Z is equal to or less than 700

calculate $\sigma_Z = 0.091\ X_Z^{0.8553}$

where X_Z is greater than 700 and less than 7000

calculate $\sigma_Z = 0.352\ X_Z^{0.6495}$

where X_Z is equal to or greater than 7000

calculate $\sigma_Z = 0.955\ X_Z^{0.53857}$

NOTES:

1. Where a building or structure adjacent to the building or structure on which the point of emission is located is within five metres of that building or structure, it shall be treated as being part of the building or structure on which the point of emission is located.

2. Where a situation exists as described in subclauses i, ii and iii of clause *b* all points of emission of a contaminant shall be considered as if the total emission comes from the building such that the building itself is a point of emission.

3. Where K yields a value greater than the concentration of the contaminant at the point of emission, the concentration of the contaminant at the point of emission shall be deemed to be the value of K.

4. The wind-oriented centre of a building or structure is obtained by circumscribing the plan view of the building or structure with the smallest possible rectangle, two sides of which are parallel to the chosen wind direction, and the intersection of the diagonals of this rectangle is the wind-oriented centre (*see figure 11*)

5. Where an emission or emissions is from only one building or structure, the wind direction shall be that direction that is parallel to a line joining the wind-oriented centre of the building or structure and the point of impingement and the value of the exponential expression involving Y is one (In such a situation the value of Y becomes zero)

6. Where emissions from only one building or structure are being evaluated the wind direction shall be so chosen that the value of G is the horizontal distance in metres between the point of impingement and a vertical line through the wind-oriented centre of the building or structure on which the point of emission is located. (*see figure 15*)

(*c*) where the point of emission is not affected by any of the conditions described in subclauses i, ii or iii of clause *a* or subclauses i, ii or iii of clause *b*, the following formula shall be applied:
(*see figures 16, 17, 18 and 19*)

$$K = \frac{10^6 \times Q \times F}{6.28 \times \sigma_Y \times \sigma_Z \times U} \times \exp\left[-\frac{1}{2}\left(\frac{Y}{\sigma_Y}\right)^2\right] \cdot \left\{\exp\left[-\frac{1}{2}\left(\frac{Z-H}{\sigma_Z}\right)^2\right] - \exp\left[-\frac{1}{2}\left(\frac{Z-H}{\sigma_Z}\right)^2\right]\right\}$$

Where K is the half hour average concentration of the contaminant at the point of impingement in micrograms per cubic metre

Q is the rate of emission in grams per second of the contaminant

U is the wind speed in metres per second

exp is the exponential function where e = 2.7183

Y is the straight line distance in metres between the point of impingement and a vertical plane through the point of emission in the chosen direction of the wind
(see figure 20)
(see note 3)

Z is the difference in height, in metres, between the point of impingement and the ground level at or beneath the point of impingement

H is the effective height of the emission of a contaminant

F is a factor related to the atmospheric stability of the air

σ_y is a function which defines the amount of dispersion of the contaminant in a horizontal direction at the point of impingement

σ_z is a function which defines the amount of dispersion of the contaminant in a vertical direction at the point of impingement

Determination of K 1. Two values for K shall be determined using the formula in clause c.

2. The maximum value obtained for K shall be applied in this Regulation.
(see note 1)

Value number 1 for K is determined as follows:

Where: U is the speed of the wind in metres per second
(see note 2)

H is determined as follows:

$$H = h + \left(\frac{v_s d}{u}\right) \cdot \left[1.5 + 2.68\,\frac{(T_s - 283)d}{T_s}\right]$$

Where: h is the height above grade, in metres, of the point of emission

v_s is the speed in metres per second in an upward vertical direction of the contaminant gas stream at the point of emission to the atmosphere
(see note 4)

d is the diameter in metres of a circle of equivalent area to that area through which the contaminant gas stream enters the air

u is the speed of the wind in metres per second
(see note 5)

T_s is the temperature in degrees Kelvin (273 + temperature in Degrees Celsius) of the contaminant gas stream at the point of emission

F is 0.6

σ_y is determined as follows:

Calculate X where X is the horizontal distance in metres between the point of emission and the line where vertical planes, one through the point of

emission and parallel to the chosen direction of the wind and the other through the point of impingement, meet at right angles
(see figure 21)
(see notes 6 and 7)

Where the value of X is equal to or less than 2500

$$\sigma_y = 0.176X^{0.92445}$$

When the value of X is greater than 2500

$$\sigma_y = 0.268X^{0.87248}$$

σ_z is determined as follows

When the value of X is determined in the calculation of σ_y is equal to or less than 2500

$$\sigma_z = 0.106X^{0.91926}$$

When the value of X is greater than 2500

$$\sigma_z = 0.120X^{0.90564}$$

(see note 8)

Value number 2 for K is determined as follows

H has the same value for H as determined for value number 1 for K

F is 0.8

σ_y is determined as follows

Where X has the same value for X as determined for value number 1 for K

Where the value of X is equal to or less than 700

$$\sigma_y = 0.110\ X^{0.93062}$$

Where the value of X is greater than 700 but less than 7000

$$\sigma_y = 0.120\ X^{0.91837}$$

Where the value of X is equal to or greater than 7000

$$\sigma_y = 0.191\ X^{0.86538}$$

σ_z is determined as follows

Where X has the same value as determined in the calculation of σ_y

Where X is equal to or less than 700

$$\sigma_z = 0.091\ X^{0.8553}$$

Where X is greater than 700 but less than 7000

$$\sigma_z = 0.352\ X^{0.6495}$$

Where X is equal to or greater than 7000

$$\sigma_z = 0.955\ X^{0.53857}$$

(*see note 8*)

NOTES:

1. Where K yields a value greater than the concentration of the contaminant at the point of emission, the concentration of the contaminant at the point of emission shall be deemed to be the value of K.

2. The wind speed shall have a minimum value of 2.235 metres per second and a maximum value of 18.235 metres per second. A value of K shall be determined for wind speed increments of 0.5 metres per second until a maximum value of K is found.

3. Where only a single point of emission is being evaluated the wind direction shall be so chosen that the value of Y becomes zero (therefore the value of exp expression containing Y becomes equal to one.)

4. Where the value of v_s is less than 7 metres per second the value of v_s shall be zero.

5. The value for u shall be consistent with the values substituted directly for u in the equation used for evaluating K.

6. Where a single source of emission is being evaluated, the wind direction shall be so chosen that the value of X shall be the horizontal distance in metres between the point of impingement and a vertical line through the point of emission. (*see figure 22*)

7. In the calculation of K at ground level, the value of X shall be so chosen that the maximum value of K is found.

8. For each point of impingement, for each wind direction chosen, and for each value of X, U shall be varied until the maximum value of K is found.

(*d*) where the emissions of a contaminant are from more than one source, the contaminant concentrations at the point of impingement, resulting from each individual source, for the conditions set out in clauses *a*, *b* and *c* shall be added together to give an aggregate value for K.

The aggregate value of K shall be determined for all wind directions and all permissible wind speeds for value of K, where applicable. The largest aggregate K obtained shall be the value of K to apply in this Regulation.

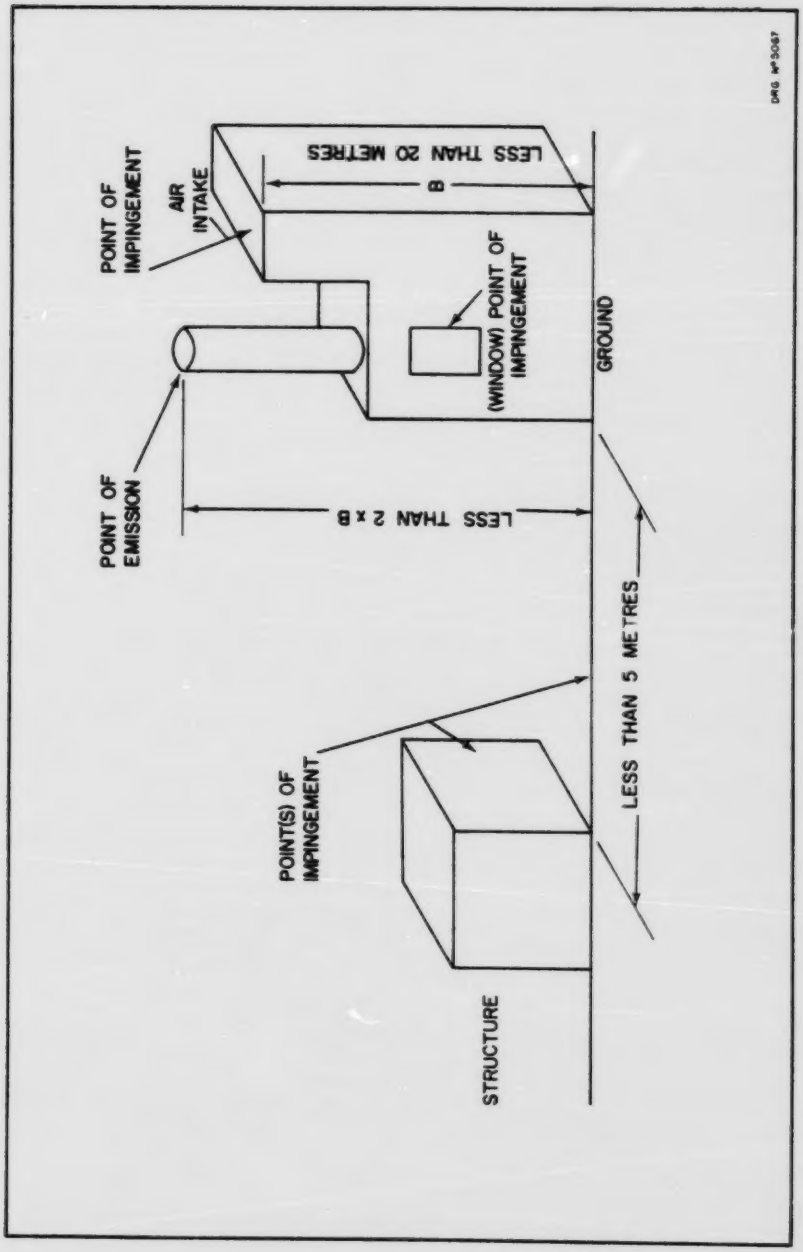
POINT OF IMPINGEMENT
AIR INTAKE
LESS THAN 20 METRES
B
POINT OF EMISSION
(WINDOW) POINT OF IMPINGEMENT
GROUND
LESS THAN 2 x B
POINT(S) OF IMPINGEMENT
LESS THAN 5 METRES
STRUCTURE
DRG Nº 3067

FIGURE 1.

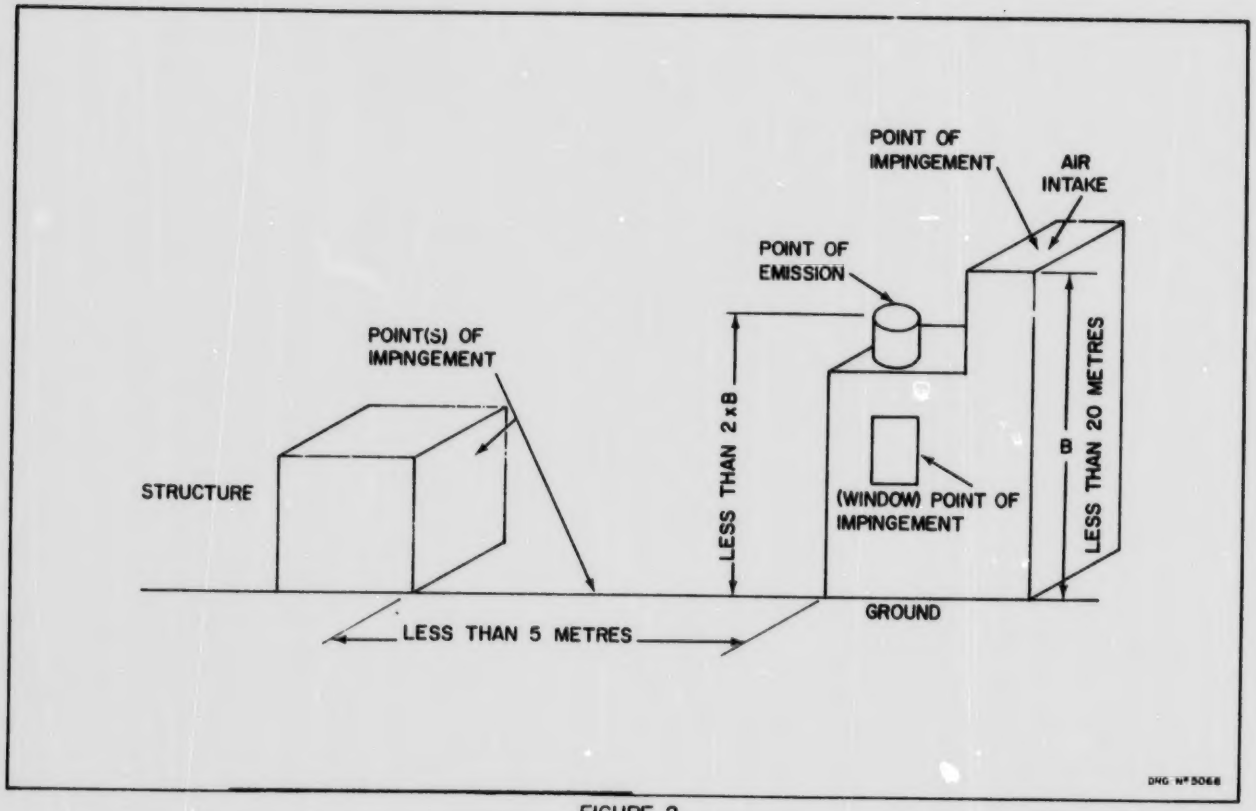
POINT OF
IMPINGEMENT
AIR
INTAKE
POINT OF
EMISSION
POINT(S) OF
IMPINGEMENT
STRUCTURE
LESS THAN 2xB
B
LESS THAN 20 METRES
(WINDOW) POINT OF
IMPINGEMENT
GROUND
LESS THAN 5 METRES
DWG. Nº 5068

FIGURE 2.

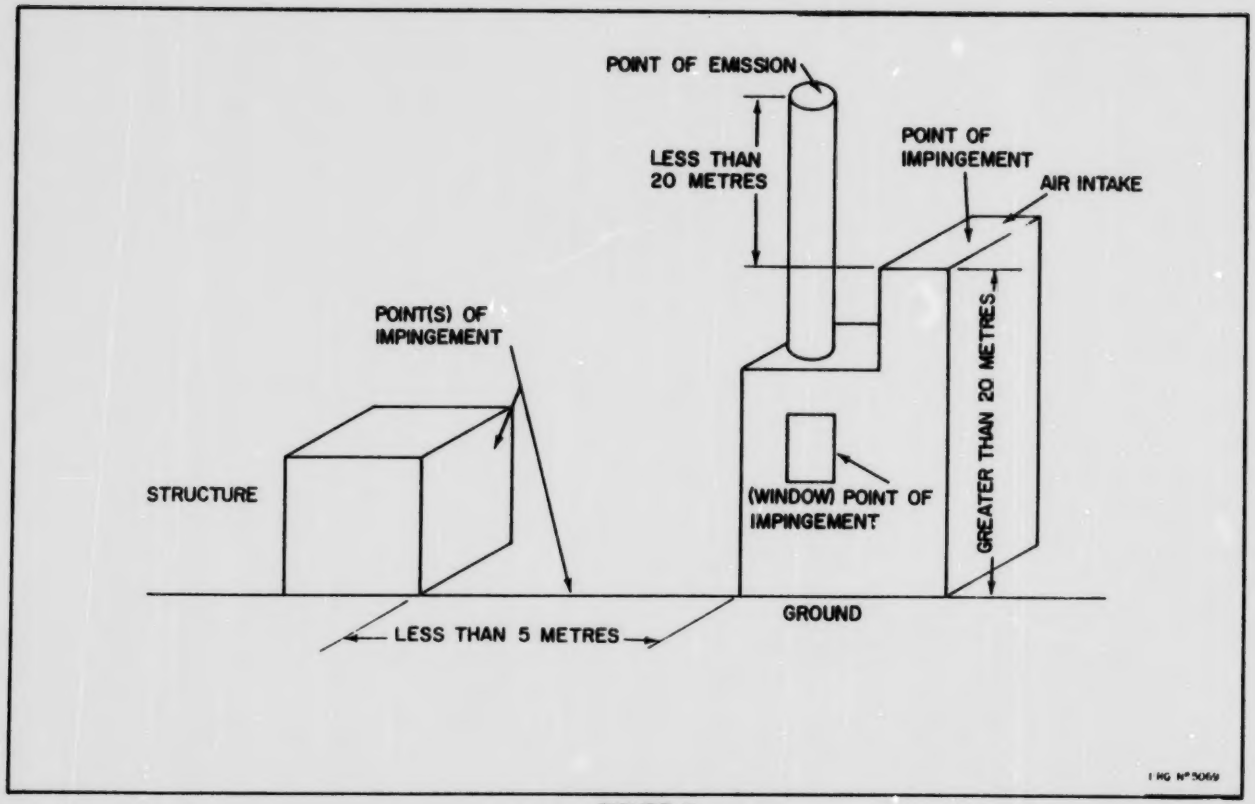
POINT OF EMISSION
LESS THAN
20 METRES
POINT OF
IMPINGEMENT
AIR INTAKE
POINT(S) OF
IMPINGEMENT
STRUCTURE
(WINDOW) POINT OF
IMPINGEMENT
GREATER THAN 20 METRES
GROUND
LESS THAN 5 METRES
FIG N° 5069

FIGURE 3.

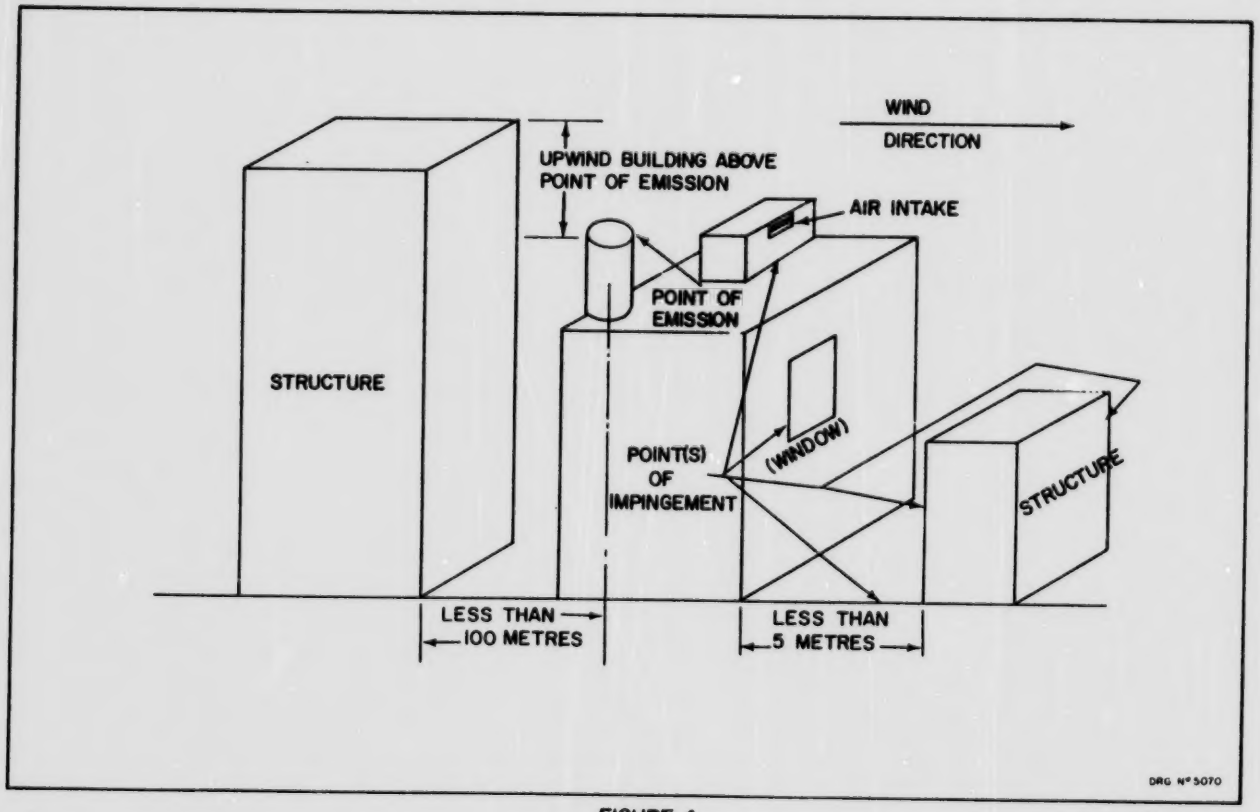
WIND
DIRECTION
UPWIND BUILDING ABOVE
POINT OF EMISSION
AIR INTAKE
POINT OF
EMISSION
STRUCTURE
(WINDOW)
POINT(S)
OF
IMPINGEMENT
STRUCTURE
LESS THAN
100 METRES
LESS THAN
5 METRES
DRG Nº 5070

FIGURE 4.

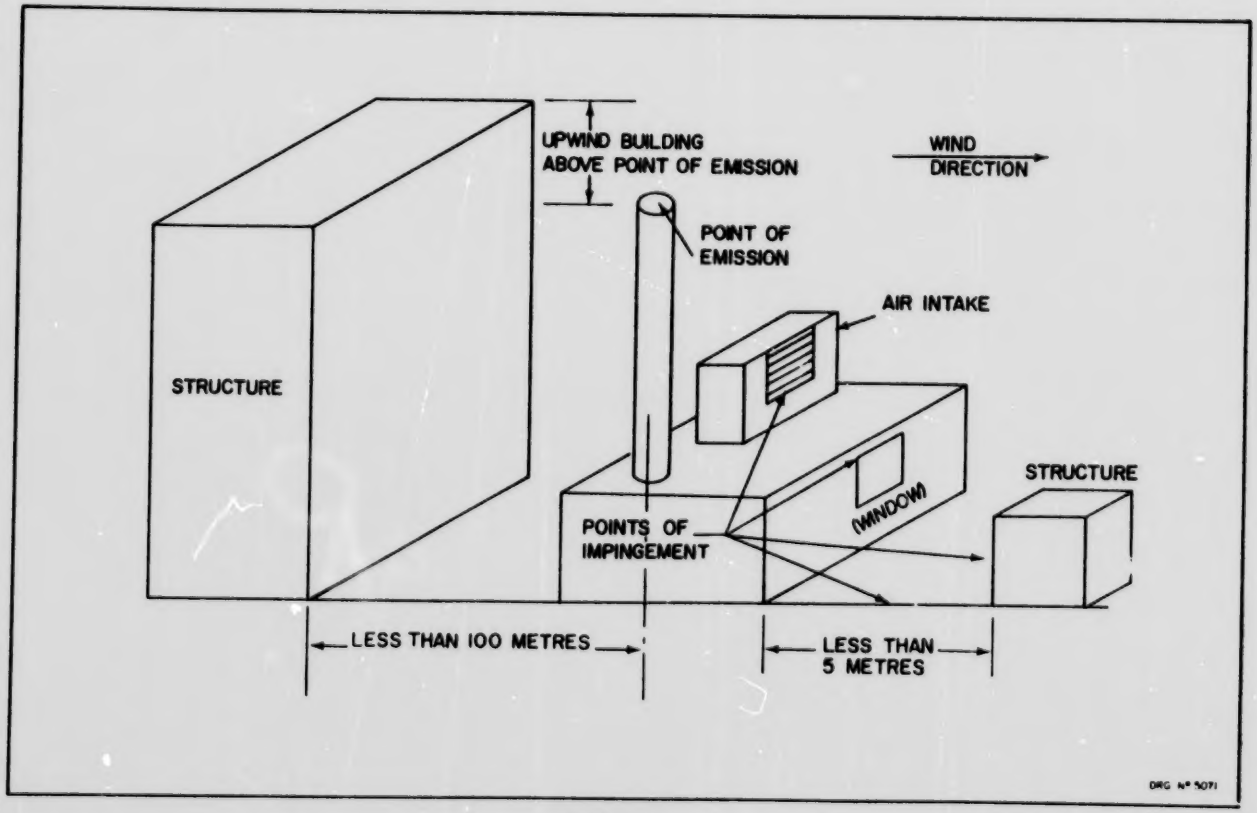
UPWIND BUILDING
ABOVE POINT OF EMISSION
WIND
DIRECTION
POINT OF
EMISSION
AIR INTAKE
STRUCTURE
STRUCTURE
(WINDOW)
POINTS OF
IMPINGEMENT
LESS THAN 100 METRES
LESS THAN
5 METRES
DRG Nº 5071

FIGURE 5.

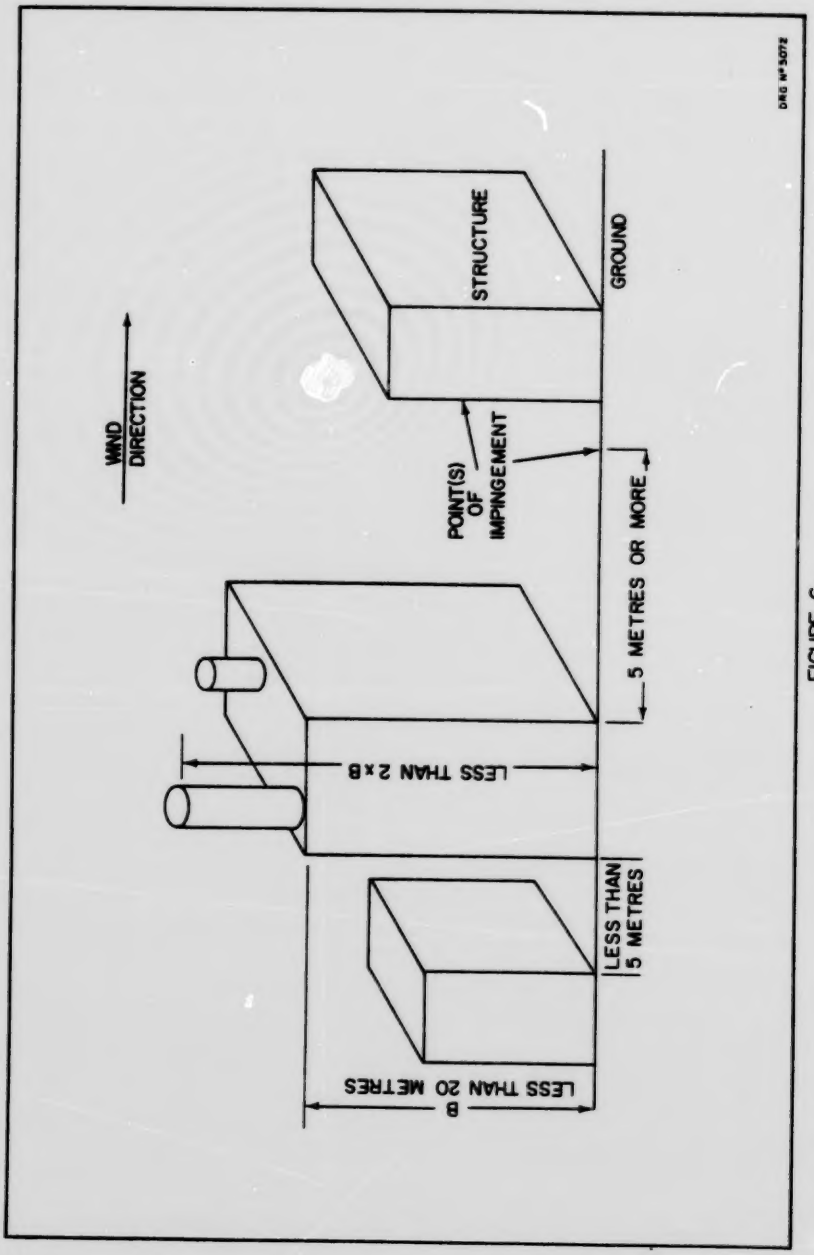
WIND
DIRECTION
STRUCTURE
GROUND
POINT(S)
OF
IMPINGEMENT
5 METRES OR MORE
LESS THAN 2 x B
LESS THAN
5 METRES
LESS THAN 20 METRES
B
DRG N° 5072

FIGURE 6.

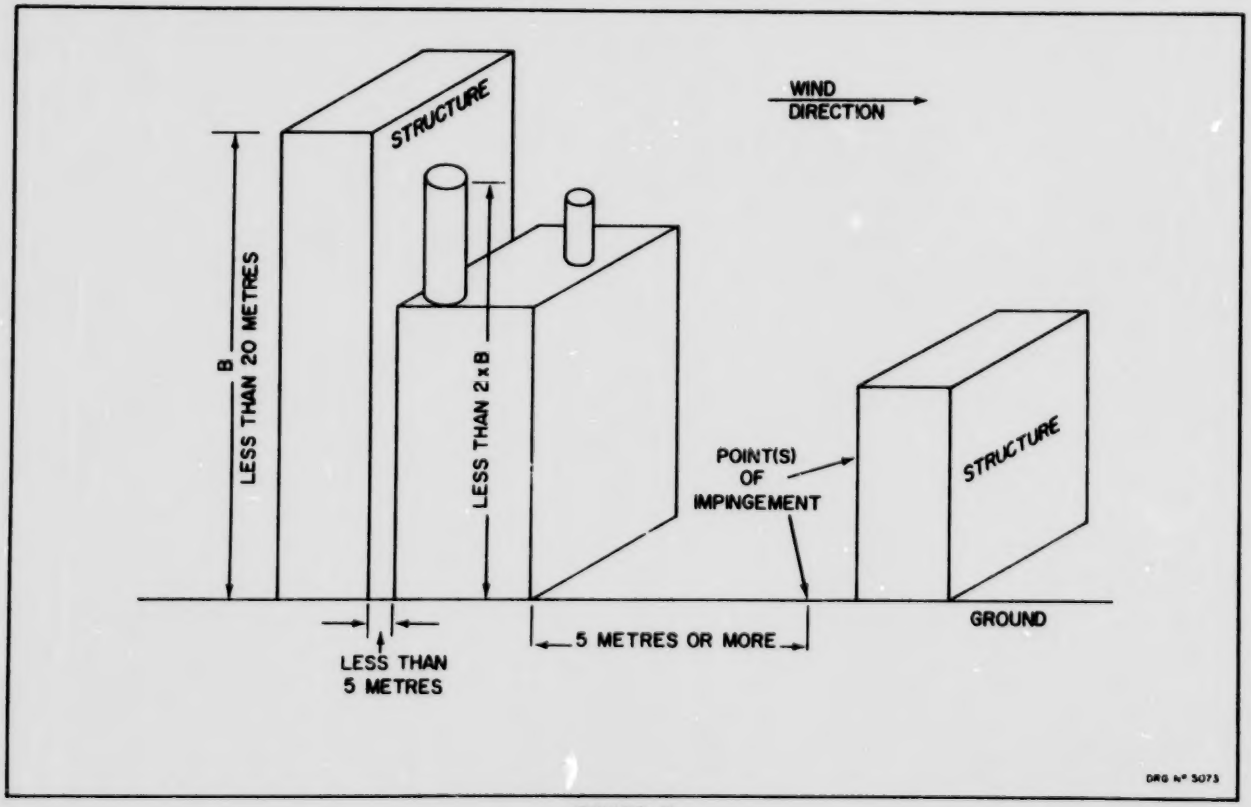
STRUCTURE
WIND
DIRECTION
B
LESS THAN 20 METRES
LESS THAN 2xB
POINT(S)
OF
IMPINGEMENT
STRUCTURE
GROUND
5 METRES OR MORE
LESS THAN
5 METRES
DRG Nº 5073

FIGURE 7.

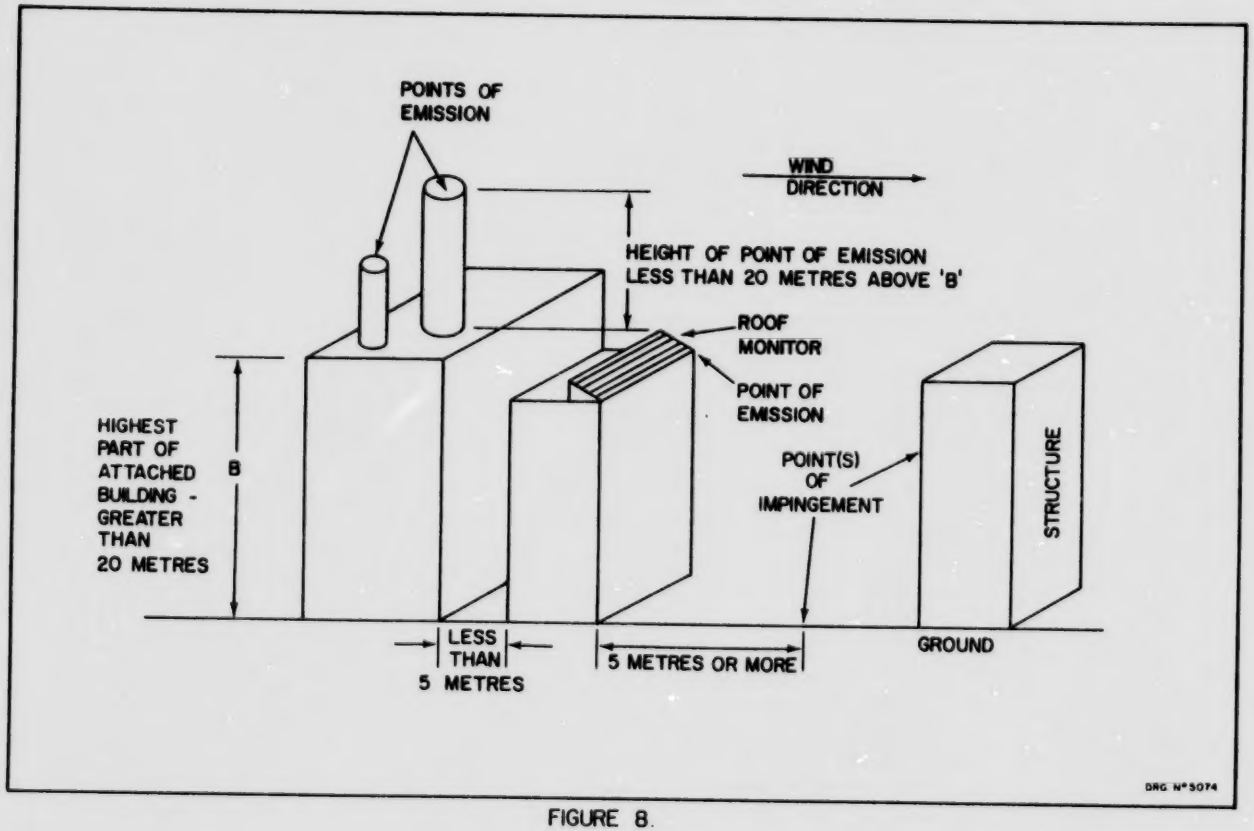
POINTS OF EMISSION
WIND DIRECTION
HEIGHT OF POINT OF EMISSION LESS THAN 20 METRES ABOVE 'B'
ROOF MONITOR
POINT OF EMISSION
HIGHEST PART OF ATTACHED BUILDING - GREATER THAN 20 METRES
B
POINT(S) OF IMPINGEMENT
STRUCTURE
LESS THAN 5 METRES
5 METRES OR MORE
GROUND
DRG N°5074

FIGURE 8.

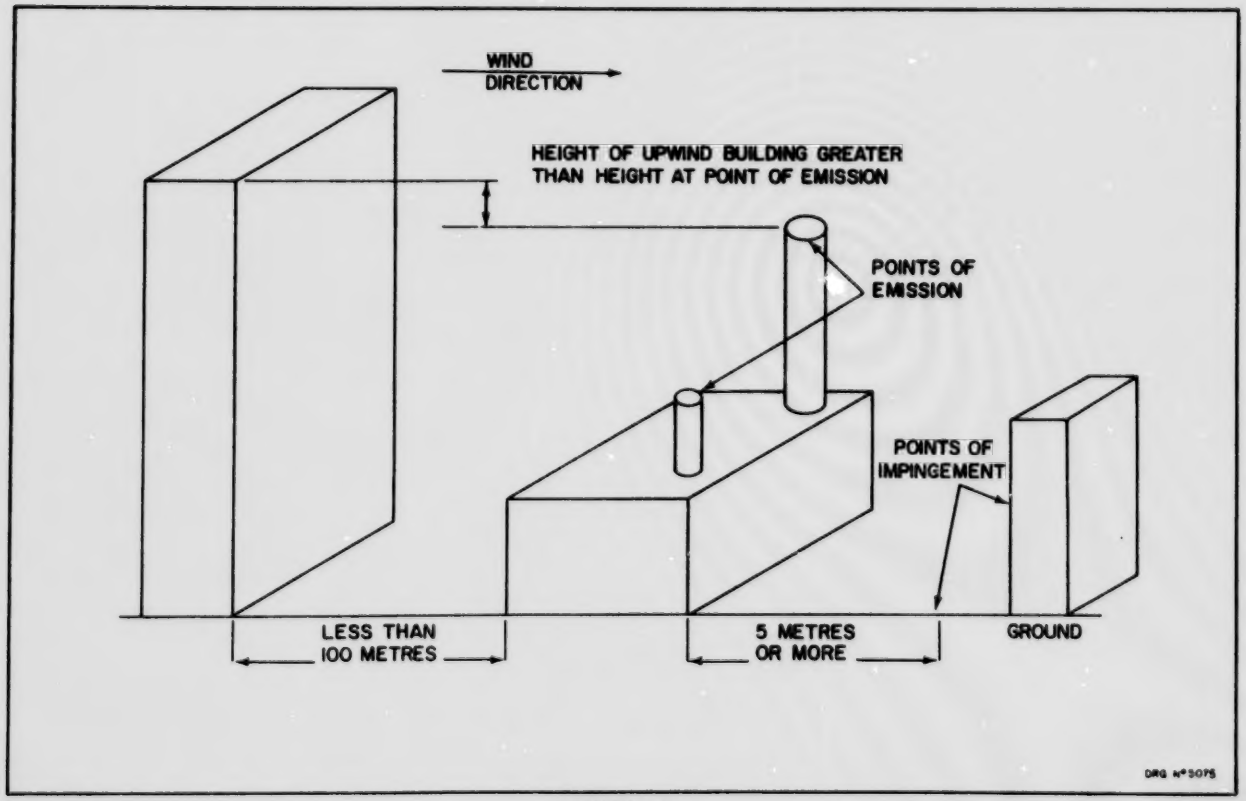
WIND
DIRECTION
HEIGHT OF UPWIND BUILDING GREATER
THAN HEIGHT AT POINT OF EMISSION
POINTS OF
EMISSION
POINTS OF
IMPINGEMENT
LESS THAN
100 METRES
5 METRES
OR MORE
GROUND
DRG. No 5075

FIGURE 9.

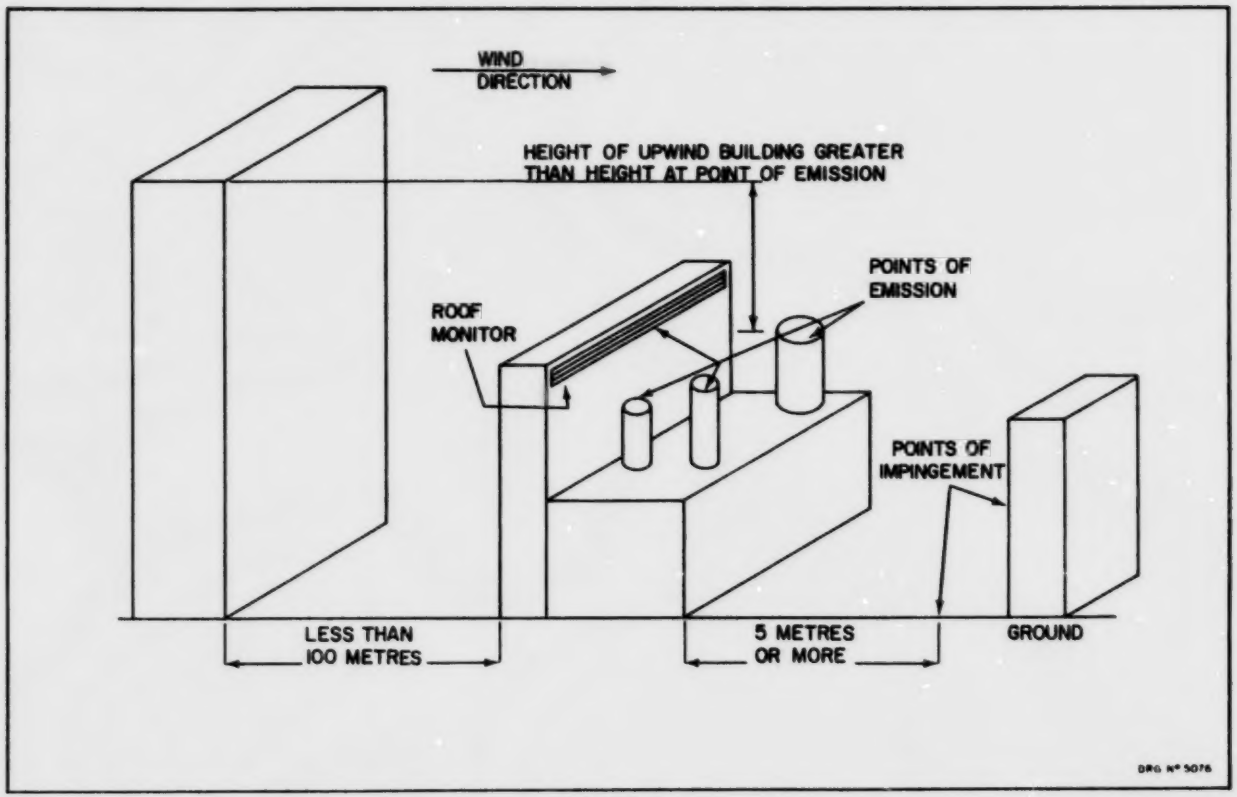
WIND
DIRECTION
HEIGHT OF UPWIND BUILDING GREATER
THAN HEIGHT AT POINT OF EMISSION
POINTS OF
EMISSION
ROOF
MONITOR
POINTS OF
IMPINGEMENT
LESS THAN
100 METRES
5 METRES
OR MORE
GROUND
DRG Nº 5076

FIGURE 10.

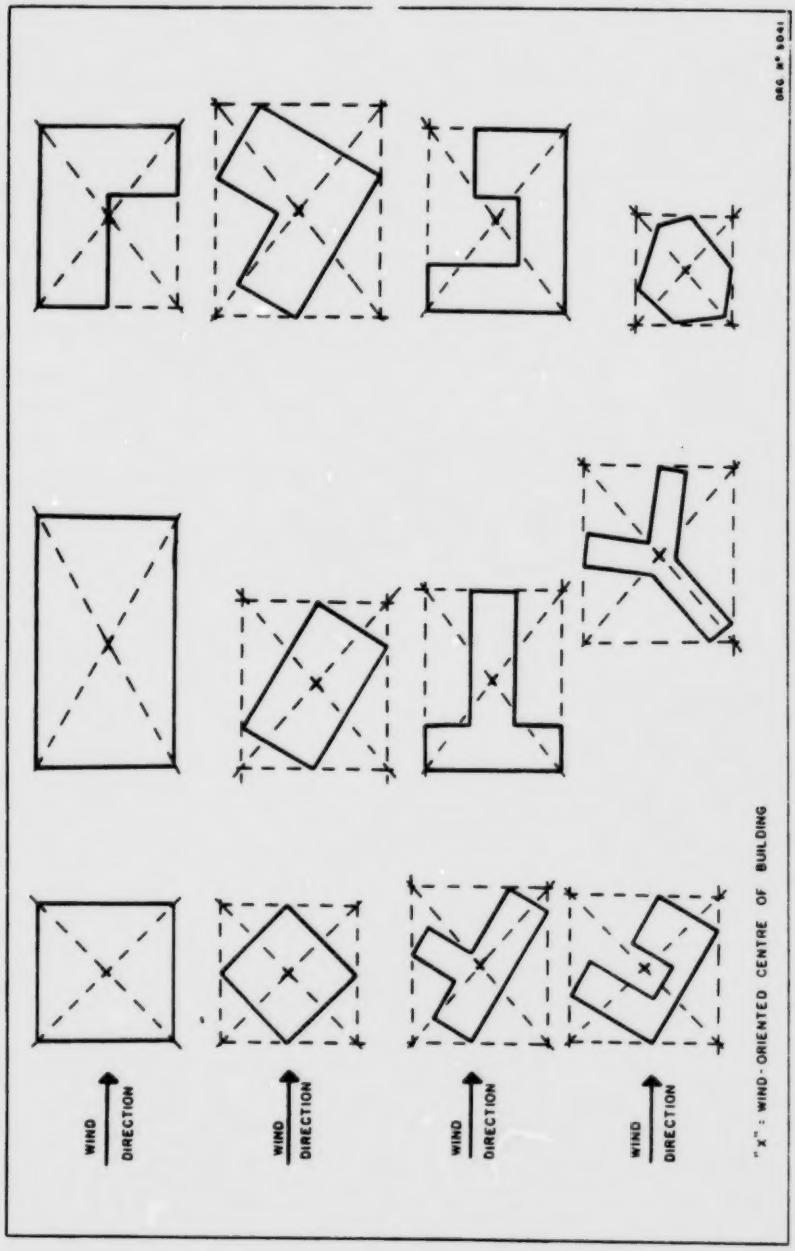
WIND DIRECTION
WIND DIRECTION
WIND DIRECTION
WIND DIRECTION
"X" : WIND-ORIENTED CENTRE OF BUILDING
DRG Nº 5041

FIGURE II

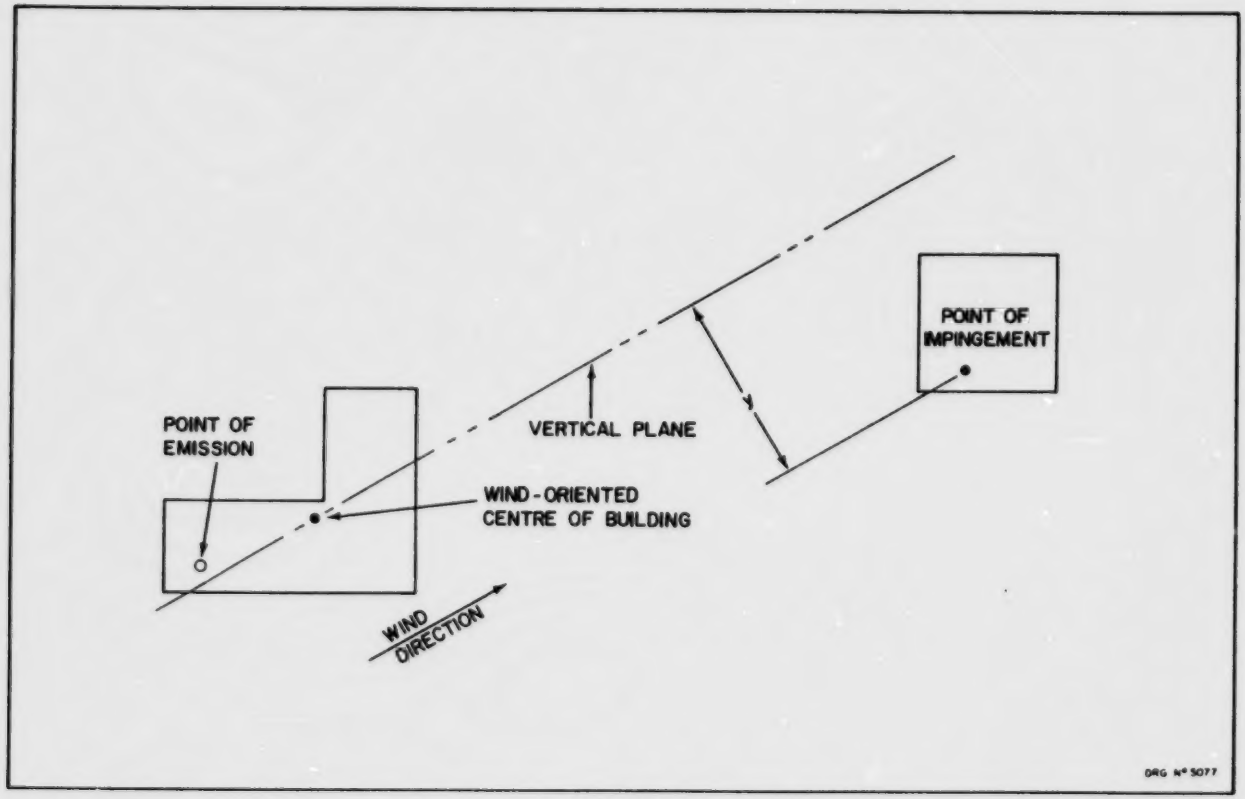
POINT OF IMPINGEMENT
VERTICAL PLANE
POINT OF EMISSION
WIND-ORIENTED CENTRE OF BUILDING
WIND DIRECTION
DRG Nº 5077

FIGURE 12.

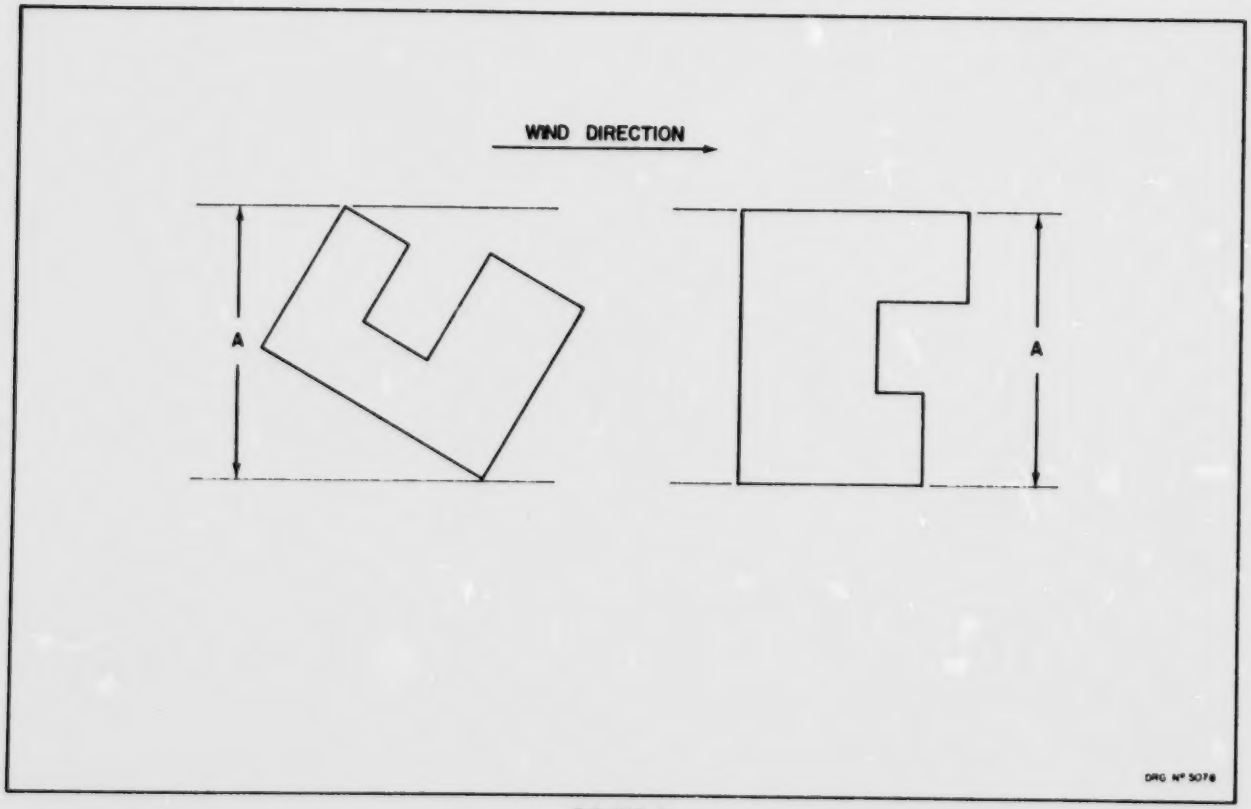

FIGURE 13

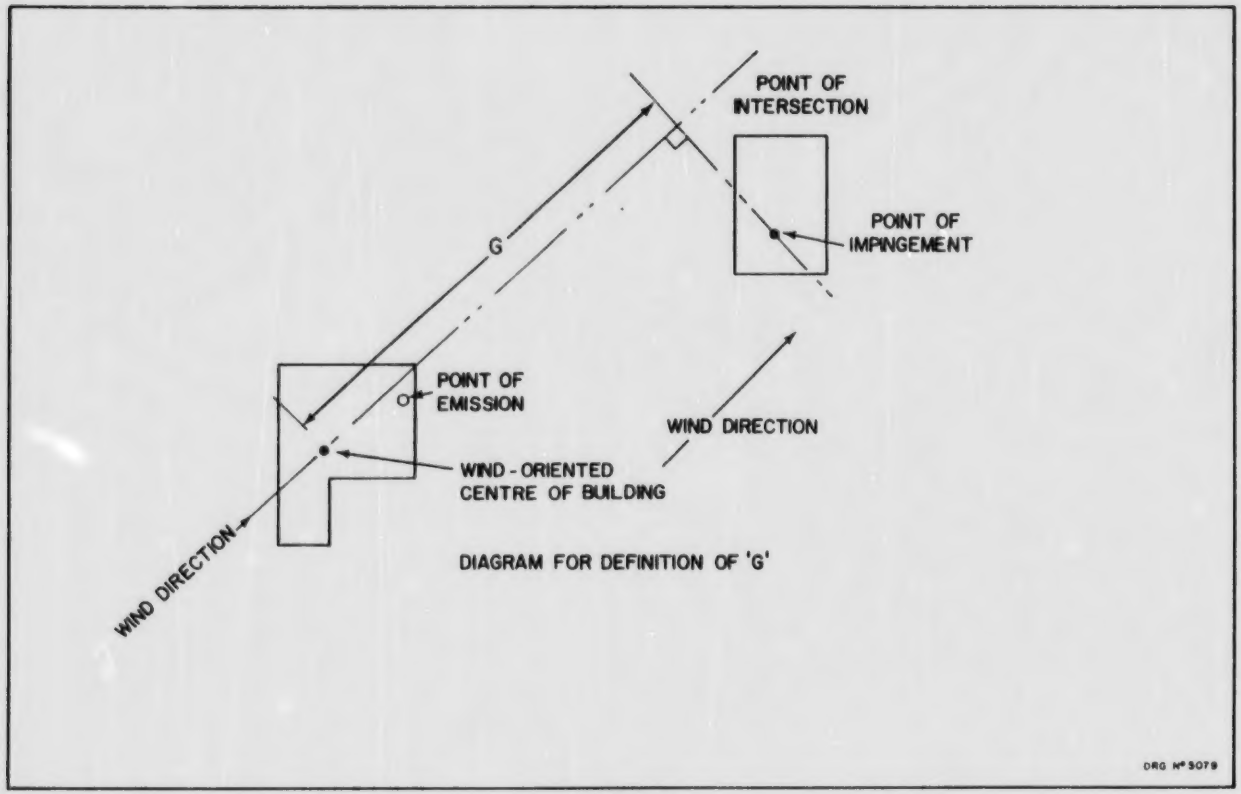
POINT OF
INTERSECTION
POINT OF
IMPINGEMENT
G
POINT OF
EMISSION
WIND DIRECTION
WIND - ORIENTED
CENTRE OF BUILDING
WIND DIRECTION
DIAGRAM FOR DEFINITION OF 'G'
DRG Nº 5079

FIGURE 14.

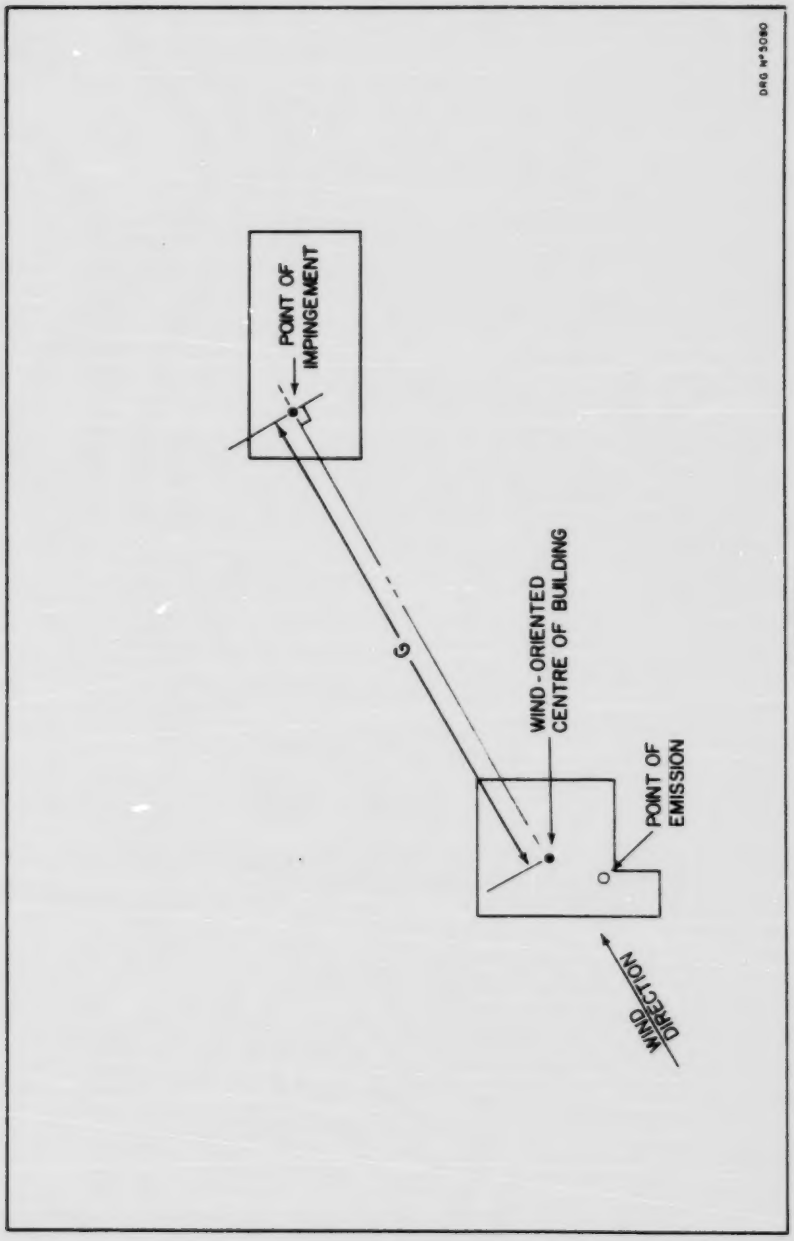
DRG Nº 5080
POINT OF IMPINGEMENT
G
WIND-ORIENTED CENTRE OF BUILDING
POINT OF EMISSION
WIND DIRECTION

FIGURE 15

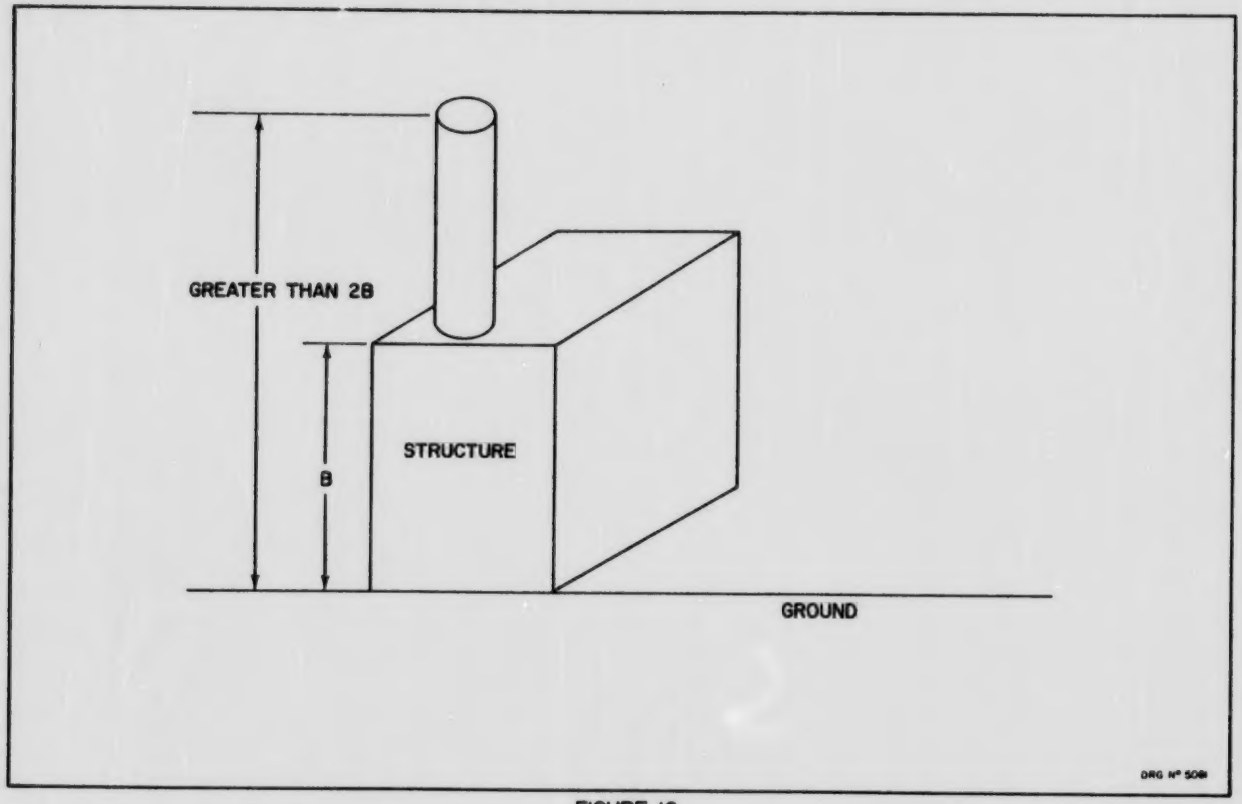

FIGURE 16.

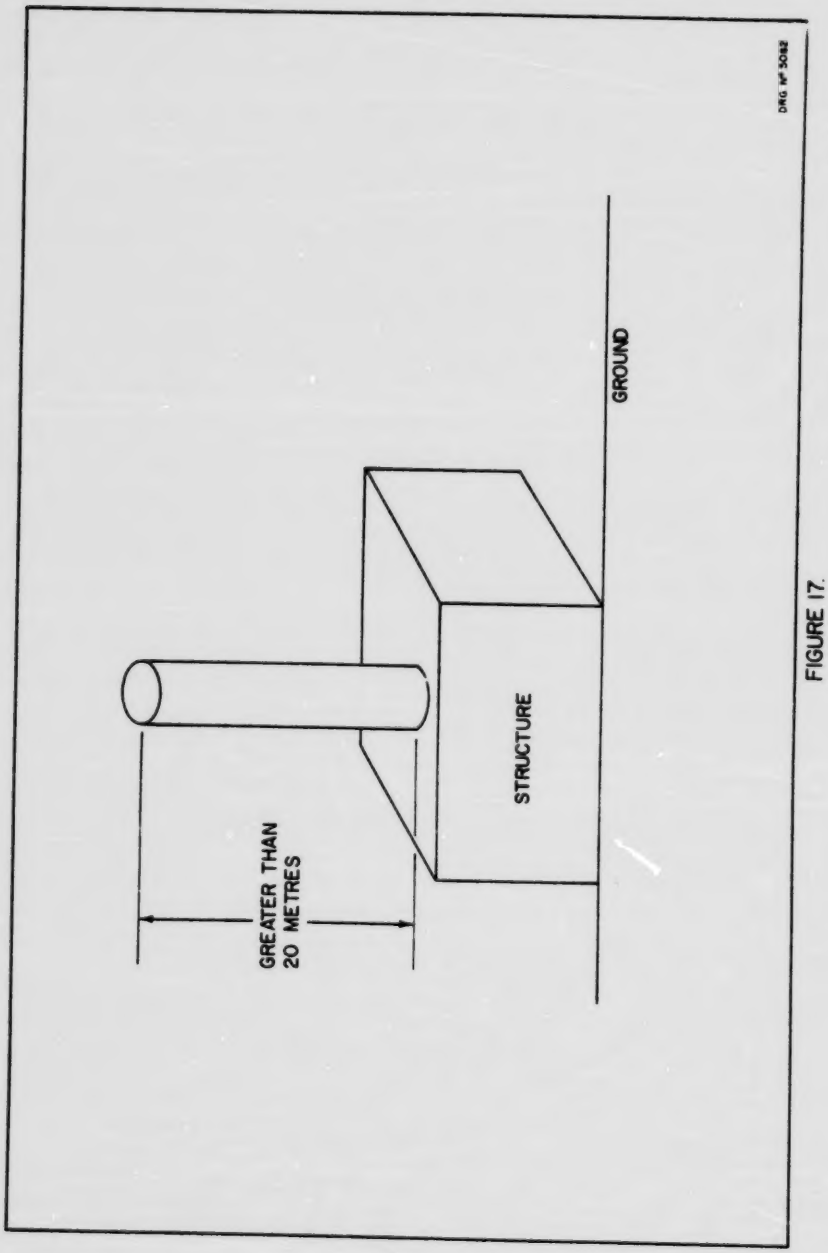

FIGURE 17.

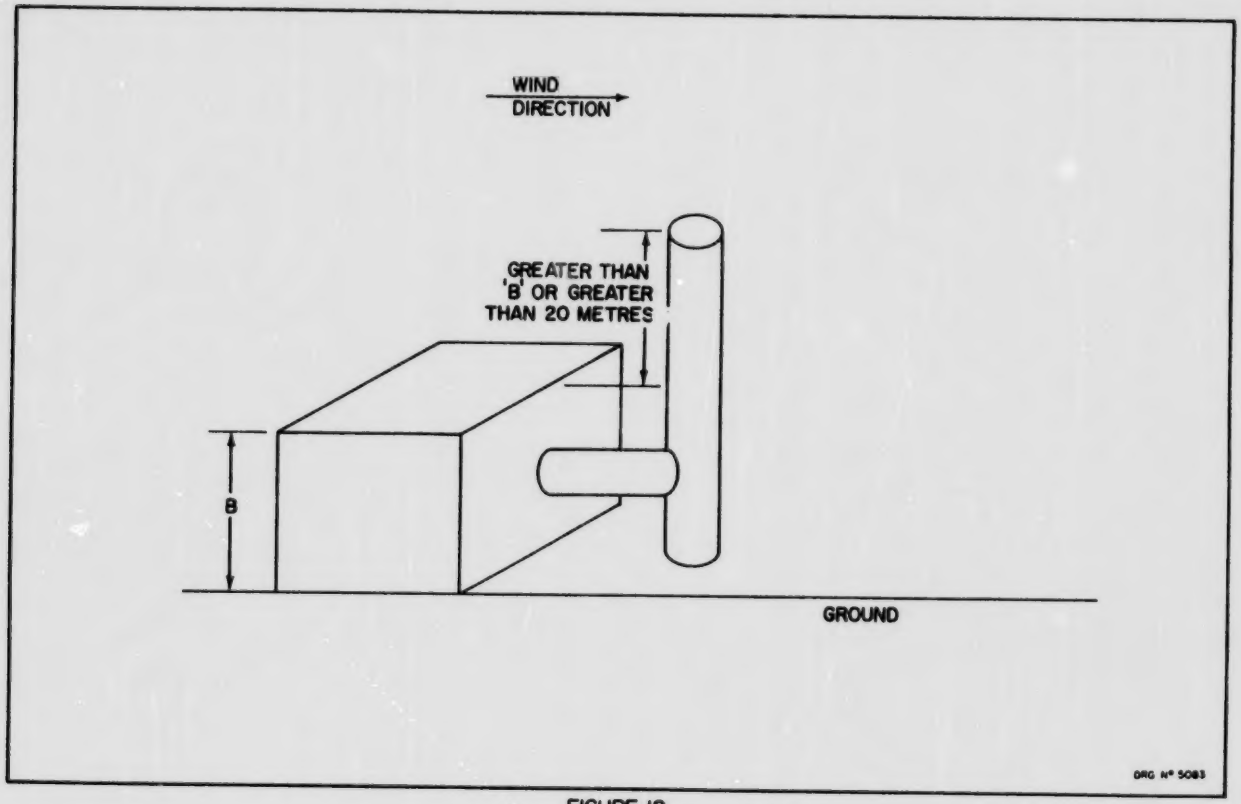
WIND
DIRECTION
GREATER THAN
'B' OR GREATER
THAN 20 METRES
B
GROUND
DRG Nº 5083

FIGURE 18.

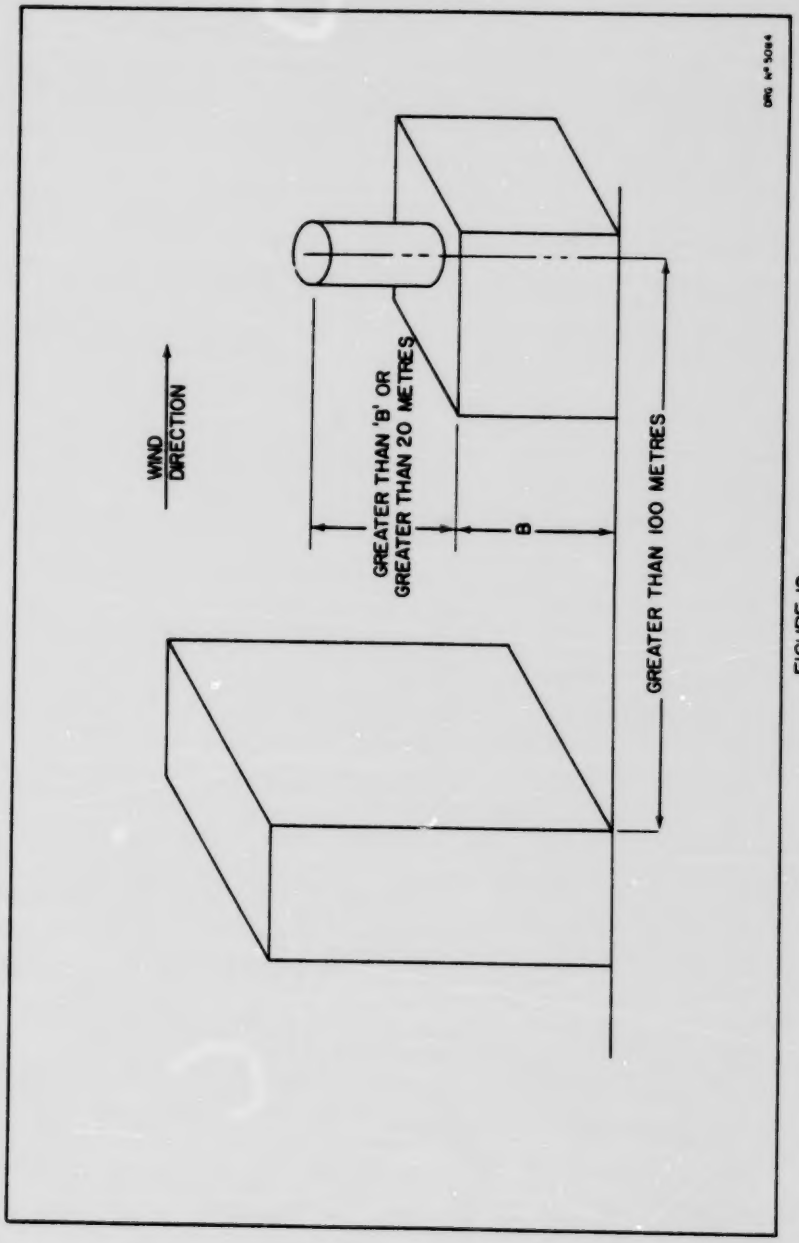
WIND
DIRECTION
GREATER THAN 'B' OR
GREATER THAN 20 METRES
B
GREATER THAN 100 METRES
DRG. Nº 5084

FIGURE 19.

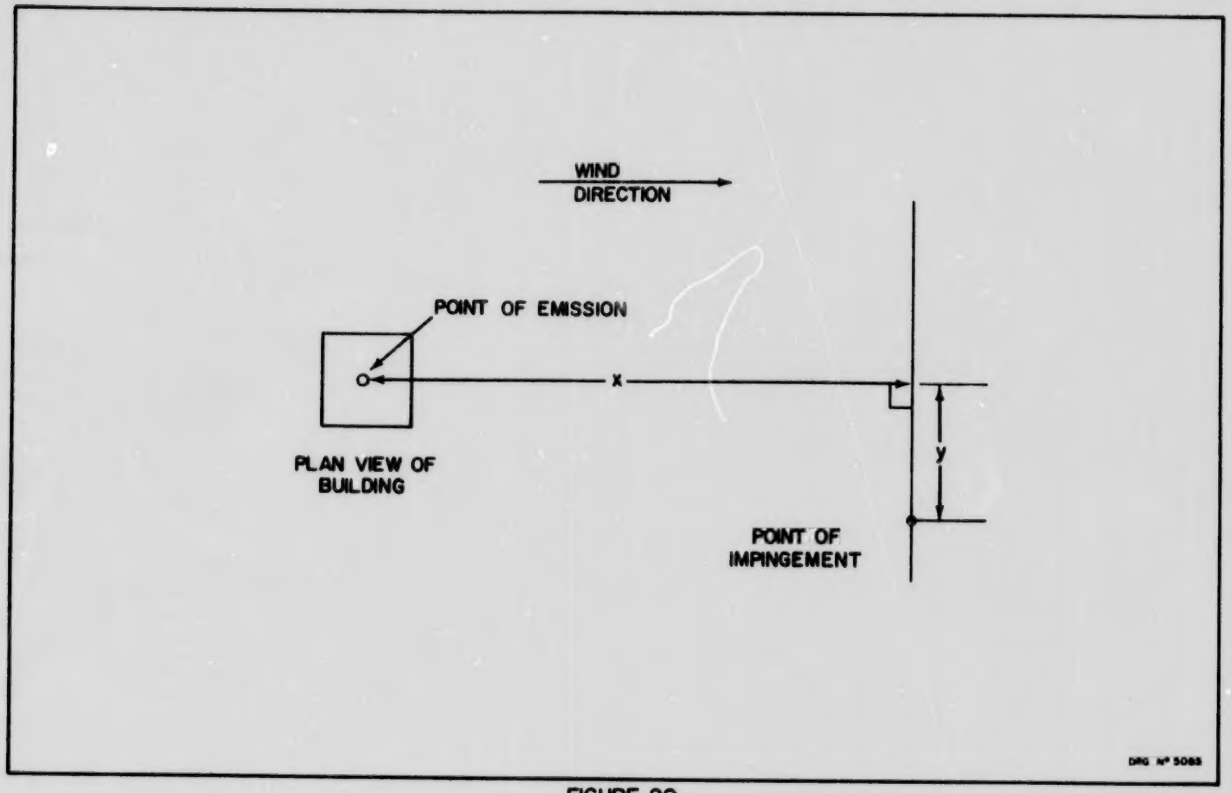
WIND
DIRECTION
POINT OF EMISSION
x
y
PLAN VIEW OF
BUILDING
POINT OF
IMPINGEMENT
DRG Nº 5085

FIGURE 20.

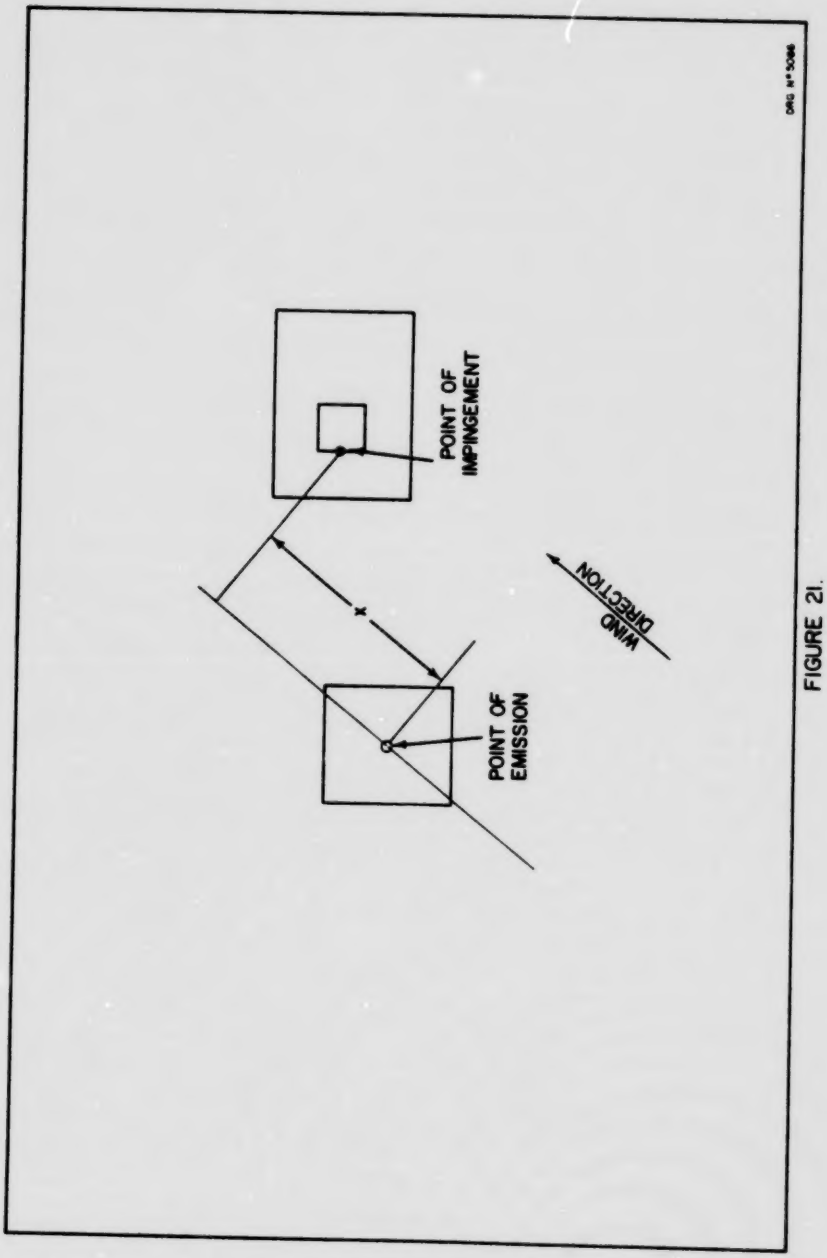

FIGURE 21.

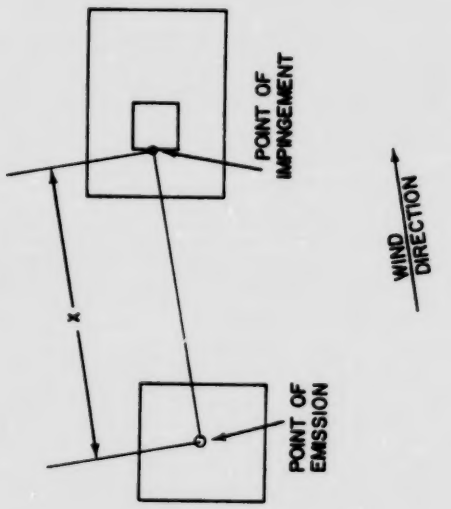

FIGURE 22.

R.R.O. 1980, Reg. 308, Appendix.

APPENDIX C

REGULATORY REQUIREMENTS - NORTH AMERICA

C-1 INTRODUCTION

This appendix provides an overview of some toxic air emission regulations in place in selected jurisdictions within North America, that are relevant to hazardous waste incineration. Federal legislation in both Canada and the U.S. is outlined, as well as legislation at the provincial and state level. Furthermore, programs developed by a number of state and city jurisdictions to control toxic air emissions are presented as representative examples of the legislative activity in the U.S.

C-2 REGULATORY REQUIREMENTS - CANADA

At the federal level, there are national ambient air quality objectives, but no emission standards, applicable to hazardous waste treatment facilities. The control of air pollutants in Canada is primarily a provincial responsibility, with the federal government providing mainly a leadership and advisory role in assisting provinces to develop their own standards. Only Alberta and Quebec have specific programs in place to control air emissions from hazardous waste facilities. Alberta has emission standards applicable to incinerators processing hazardous wastes (see Table C-1). In addition, control technology (i.e., tail gas scrubber and electrostatic precipitator or the equivalent) is required so that these emission standards are not exceeded.

Quebec has established emission standards applicable to new hazardous waste incinerators (Table C-1) and general ambient air quality standards (Table C-2). In addition, the following emission standards apply to existing hazardous waste incinerators: particulates (TSP) - 150 mg/m^3 and hydrogen chloride (HCl) - 150 mg/m^3. If wastes contain greater than 0.2 percent halogens by weight, then the incinerator must be equipped with a control device to limit the emissions of halogenated matter into the atmosphere.

C-3 REGULATORY REQUIREMENTS - UNITED STATES

Federal legislation, e.g., the Clean Air Act, includes national ambient air quality standards (NAAQS) for sulphur dioxide (SO_2), carbon monoxide (CO), ozone (O_3), nitrogen dioxide (NO_2), lead (Pb), and particulates (TSP) (Table C-3). In addition, national emission standards for hazardous air pollutants (NESHAPS) exist for the following compounds: asbestos (A), benzene, beryllium (Be), mercury (Hg), radionuclides and vinyl chloride (Table C-4).

In addition to meeting the requirements of federal legislation, various jurisdictions in the U.S. have, or are in the process of developing, programs to control toxic air pollutant emissions. The city of Philadelphia, the states of New York, California, Kentucky, Illinois, Maryland and Colorado were contacted for information on their specific programs. The programs in these jurisdictions were chosen as representative examples of the activity in the U.S. concerning control of toxic air pollutant emissions.

Philadelphia

The Air Pollution Control Board of the Philadelphia Department of Public Health was contacted for information on the city's program to control air emissions. The stated objectives of this program are to meet national ambient air quality standards (NAAQS) for criteria pollutants and to control known or suspected carcinogens. The city has developed air quality guidelines for 99 substances (Table C-5) using toxicological data from the Environmental Protection Agency (EPA), the American Conference of Governmental Industrial Hygienists (ACGIH) and the National Toxicological Program (NTP).

Compounds are classified in one of the three following groups:

1. Criteria pollutants - this is for compounds so listed by the EPA.

2. Carcinogenic pollutants - this is for compounds so listed by the ACGIH or NTP.

3. Non-carcinogenic pollutants - this is for all other compounds.

Following compound classification, ambient air guidelines are developed by making adjustments to available data. Adjustments are made to account for continuous exposures, provide an additional margin of safety when a compound is a carcinogen, account for species differences when animal data is used, and account for differences in human susceptibility (Table C-6).

Finally, information on physical properties, analytical methods, occupational exposure limits, ambient levels (if available), toxicological effects and guidelines and their bases, is documented for each compound for which the city has developed an air quality guideline.

New York

The Division of Air Resources of the New York State Department of Environmental Conservation was contacted for information on the state's program to control air emissions. The components of the program include a computerized inventory of emissions from industrial sources within the state and air quality guidelines for over 250 compounds.

Compounds are classified in one of the three following groups:

1. High toxicity - this is for compounds that are demonstrated or suspected human carcinogens, or that pose a significant risk to humans. Examples of evidence of potential carcinogenicity are demonstrated effects from long-term studies on two animal species, demonstrated effects from long-term studies on one animal species in two independent tests, and demonstrated effects from long-term studies on one animal species combined with demonstrated effects from short-term tests. Examples of evidence of a significant risk to

humans are the presence of irreversible or progressive effects, and acute toxicities of LD_{50} (oral) $\leq$50 mg/kg or LC_{50} (inhalation) $\leq$200 ppm or LD_{50} (dermal) $\leq$200 mg/kg.

2. Moderate toxicity - this is for compounds that are animal carcinogens, mutagens, teratogens or that pose a significant risk to humans. An example of evidence of animal carcinogenicity is demonstrated effects in tests on at least one species. An example of mutagenicity is transmissible changes occurring in "in vivo" and "in vitro" tests. Non-transmissible birth defects are evidence of teratogenicity. Examples of evidence of a significant risk to humans are significant chronic effects observed in animals in inhalation studies, strong irritation at concentrations at or below the occupational threshold limit value, and acute toxicities of LD_{50} (oral) <500 mg/kg or LC_{50} (inhalation) <200 ppm or LD_{50} (dermal) <1000 mg/kg.

3. Low toxicity - this is for compounds that are not confirmed animal carcinogens or whose main effect is mild irritation experienced by sensitive members of the population at concentrations below the occupational threshold limit value.

Air quality guidelies are developed either by risk assessment or by making adjustments to occupational data from the ACGIH. In the case of high toxicity compounds, risk assessment is used to develop contaminant-specific acceptable ambient levels (AALs) that represent maximum annual average ambient concentrations. As there are many compounds and the process of developing contaminant-specific AALs is lengthy, interim AALs are also used. The interim AAL is derived by dividing the ACGIH threshold limit value - time weighted average (TLV-TWA) by a safety factor of 300. In the case of moderate toxicity compounds, contaminant-specific AALs are only developed if no TLV-TWA is

available and if the compound is found in sufficient quantities in the ambient atmosphere. Otherwise, TLV-TWAs divided by a safety factor of 300 are used. In the case of low toxicity compounds, AALs are usually developed by dividing the TLV-TWAs by a safety factor of 50. Only if no TLV-TWA is available and the compound is found in sufficient quantities in the ambient air are contaminant-specific AALs developed. Furthermore, for compounds not yet classified but for which a TLV-TWA is available, moderate toxicity is assumed in calculating the AAL. Finally, in the case of compounds having no classification and no TLV-TWA but having either a carcinogenic effect or posing a significant risk to humans, risk assessment is used to develop contaminant-specific AALs. The air quality guidelines used by the State of New York are found in Table C-7.

California

The Air Resources Board of the State of California was contacted for information on the state's program to control air emissions. The philosophy underlying the regulatory program in this state is that "while absolute and undisputed scientific evidence may not be available to determine the exact nature and extent of risk from toxic air contaminants, it is necessary to take action to protect public health".

The California air toxics program focusses on carcinogens. It is based on risk assessment and risk management. Risk assessment has been defined as the characterization of potential adverse health effects of human exposures to environmental hazards. Risk management has been defined as the process of evaluating alternative regulatory actions for mitigating those risks (NRC, 1983). Scientific considerations in determining the levels of risk associated with given exposures are taken into account as well as social, economic and political considerations in determining what level of risk is acceptable.

Compounds are classified in either level 1 or 2 (see Table C-8), depending upon the risk to public health, the amount of emissions (both actual and potential), compound use, persistence in atmosphere and ambient atmosphere concentrations in California. Compounds are classified in level 1 if they are of significant concern in California and if there is sufficient information available to pursue listing as a toxic air contaminant. Compounds are further subdivided into group 1A if significant information has been received and into group 1B if there is significant information pending. Finally, compounds are classified in level 2 if they are of potential concern in California.

Risk assessment is performed on compounds selected for regulation, with priority given to level 1A compounds. Risk assessment includes evaluation of health effects from available toxicological data and evaluation of exposure from emissions data from the state of California. Then a range of risk associated with an expected level of exposure is determined. In addition, if there is evidence of a threshold, a threshold exposure level below which no adverse health effects are expected is recommended. A draft report containing all this information is prepared and sent out for public comment. Public comments and the government responses to them are incorporated into the draft report which is then sent to the scientific review panel for evaluation. Up to and including this stage, the process is expected to last about ten months for each compound.

Risk management involves deciding what level of risk is acceptable (i.e., adequate to protect public health). To aid in this decision, a second report is prepared discussing the need for control of the compound of concern as well as the various control measures being considered. The report identifies sources, describes present and future emissions and atmospheric characteristics, discusses the various control options (in terms of availability, feasibility, cost and effectiveness),

and considers substitute compounds and environmental impacts. Decisions are then made as to which control measures are to be adopted. In the case of non-carcinogens, a threshold level is set and controls resulting in ambient levels below this threshold are required. In the case of carcinogens, no threshold level is set, but the lowest achievable emission rate (LAER) and the best available control technology (BACT) are required. Once the decision as to which control measures to adopt is made, local districts have six months to adopt equally or more stringent controls. In total, the risk management phase is expected to last 14-18 months for each compound.

Since the state of California had just started to implement its air toxics program at the time that information was requested, no compound had yet completed the risk assessment/management process.

Kentucky

The Division of Air Pollution Control of the Kentucky Department for Environmental Protection was contacted for information on the state's program to control air emissions. The state has drafted regulations to control ambient air quality by setting acceptable ambient limits (AALs) and emission limits.

In the case of non-carcinogens, 8-hour and 1-hour AALs are set. AALs are derived from occupational data that has been adjusted to account for continuous exposure by sensitive individuals. The 8-hour AAL is derived from the threshold limit value-time weighted average (TLV-TWA), whereas the 1-hour AAL is derived from the threshold limit value-ceiling (TLV-C). The TLV-TWA represents the time weighted average concentration that should not be exceeded for an 8-hour workday over a 40-hour workweek, whereas the TLV-C represents the instantaneous concentration that should not be exceeded at any time during work exposure.

For emissions that occur more than 40 hours/week, the 8-hour AAL expressed in mg/m^3 is equal to 4 x TLV-TWA/xy; the 1-hour AAL, also expressed in mg/m^3, is equal to TLV-C/xy, where x is the duration of emissions in hours/day and y is the duration of emissions in days/week. For emissions that occur less than 40 hours/week, the AAL (which can be either 8-hour or 1-hour) is equal to TLV/10 (which can be TLV-TWA or TLV-C).

Emission limits are also set in the case of non-carcinogens and are determined by the following formula: E allowable = E actual x AAL/C where E allowable is the allowable emission rate expressed as an average for a time period corresponding to the AAL averaging period, E actual is the actual emission rate, AAL is the acceptable ambient limit determined on a case-by-case basis taking into account the physical parameters of the emission points and the emission rate of the toxic air pollutant, and C is the maximum ground level concentration in the ambient air estimated by dispersion modelling.

In the case of carcinogens, existing data from the International Agency for Research on Cancer (IARC) and the National Toxicology Program (NTP) is used in the risk assessment/management process to determine "acceptable risk". In determining "acceptable risk", it is assumed that: carcinogens have no threshold, i.e., that there is a linear dose-effect relationship, emissions are continuous, individuals are exposed to the maximum ground level concentration continuously for 70 years, and 100% of the inhaled dose is absorbed. Unit risk factors are determined by extrapolation for various known or suspected carcinogens (Table C-9). These unit risk factors are then used to calculate the cancer risk posed by the compound of interest for each receptor site within 50 km of the source. The cancer risk is defined as the product of the unit risk factor and the annual average ambient concentration of the carcinogen at each receptor site (where the annual average ambient

concentration is determined by long-term dispersion modelling). The cancer risk thus calculated is then used to determine the annual excess incidents of cancer which is defined as the sum of the products of the cancer risk and the population of each receptor segment divided by 70. The calculated cancer risk and annual excess incidents are compared to the acceptable excess cancer risk and the acceptable excess incidents. The acceptable excess risk is less than 1 in 1,000,000 within 50 km from a source, while the acceptable excess incidents are less than 1 per year within the area bounded by a circle with a radius of 50 km. Facilities are required to control emissions such that the acceptable excess risk and acceptable excess incidents for each compound are not exceeded.

Illinois

The Division of Air Pollution Control of the Illinois Environmental Protection Agency was contacted for information on the state's program to control air emissions. The objective of the state's program is to meet RCRA requirements. Proposed amendments to these regulations include listing hazardous compounds by name and also including concentrations in waste which are considered to be hazardous (Table C-10). Another proposed amendment is to consider all wastes containing carcinogens listed by the National Toxicology Program (NTP) as hazardous, and therefore, subject to regulatory requirements.

Maryland

The Maryland Department of Health and Mental Hygiene is developing a program to control toxic air emissions. The components of the proposed program include an inventory of routine toxic emissions, evaluation of the impact of emissions on ambient air quality and control technology requirements for new sources.

The impact of emissions is to be evaluated using a two-tiered approach. Firstly, emissions are compared to screening levels. These levels are used to determine whether a more in-depth analysis is required to determine the ambient levels that should be achieved by the source. In the case of carcinogens, the screening level is set at a point where a continuous lifetime exposure would result in an increased cancer risk of 1 in 1,000,000. In the case of non-carcinogens, the screening level is set at 1/100 x TLV-TWA.

Colorado

The Air Pollution Control Division of the state of Colorado was contacted for information on the state's program to control air emissions. The components of the program being developed include a list of compounds to be regulated (Table C-11) and exposure limits for these compounds. Exposure limits are to be adjusted occupational limits.

REFERENCE

National Research Council (NRC), 1983, "Risk Assessment in the Federal Government; Managing the Process", National Academy Press, Washington, D.C.

TABLE C-1

Emission Standards Applicable to Hazardous Waste Incinerators in Alberta and Quebec

Pollutant	Emission Standard (mg/m^3) Alberta	Quebec
Particulates (TSP)	70	50
Hydrogen Chloride (HCl)	150	75
Sulphur Dioxide (SO_2)	650	200
Hydrogen Fluoride (HF)	7	5
Hydrogen Bromide (HBr)	-	5
Carbon Monoxide (CO)	140	-
Chlorinated Organics	0.1 g/kg	-
Phosphorus Pentoxide (P_2O_5)	-	10

TABLE C-2

General Ambient Air Quality Standards in Quebec

Pollutant	Ambient Standards (averaged over various time periods ($\mu g/m^3$))					Comparison to National Ambient Air Quality Objectives
	1 h	8 h	24 h	1 yr	Other	
Particulates (TSP)			0-150	0-70*		the 24h average is within the tolerable range and the 1 yr average within the acceptable range of the national ambient air quality objectives
Dustfall					0-7.5** T/km^2	no national ambient air quality objectives
Sulphur Dioxide (SO_2)	0-1310		0-288	0-52		the 24 h & the 1 yr average are within the acceptable range, while the 1 h average is over the acceptable range
Carbon Monoxide (CO)	0-34000	0-15000				both the 1 h and the 8 h average are within the acceptable range
Ozone (O_3)	0-157					the 1 h average is within the acceptable range

TABLE C-2 (cont'd)

General Ambient Air Quality Standards in Quebec

Pollutant	Ambient Standards (averaged over various time periods ($\mu g/m^3$))					Comparison to National Ambient Air Quality Objectives
	1 h	8 h	24 h	1 yr	Other	
Hydrogen Sulphide (H_2S)	0-14				0-11 (2 h avg)	no national ambient air quality objectives
Nitrogen Dioxide (NO_2)	0-414		0-207	0-103		the 1 hr and 24 h averages are within the tolerable range while the 1 yr average is over the acceptable range
Lead (Pb)				0-2 (geo. mean)		no national ambient air quality objectives.

Notes:

* geometric mean
** tons per square kilometer (averaged over 30 days)

TABLE C-3

U.S. National Ambient Air Quality Standards

Pollutant	Standards			
	Primary*		Secondary*	
	Conc. ($\mu g/m^3$)	Averaging Period	Conc. ($\mu g/m^3$)	Averaging Period
Sulphur dioxide (SO_2)	80	12 consec. months	1300	3 hr maximum
	365	24-hr max.		
Carbon monoxide (CO)	10 mg/m^3 40 mg/m^3	8-hr max. 1-hr max.	10 mg/m^3 40 mg/m^3	8-hr maximum 1-hr maximum
Ozone (O_3)	235	1-hr max.	235	1-hr maximum
Nitrogen Dioxide (NO_2)	100	12 consec. months	100	12 consec. months
Lead (Pb)	1.5	3 consec. months		
Particulates	260 75	24-hr 12 months**	150 60	24-hour 12 months**

Notes:

* Standards — Primary - aim to protect public health (with an adequate margin of safety from adverse health effects). Secondary - aim to protect public welfare such as protection of plants and animals, buildings and materials and visibility, from the adverse effects of pollutants

** geometric mean

TABLE C-4

U.S. National Emission Standards for Hazardous Air Pollutants

Pollutant	Emission Standards
Asbestos	Emisson requirements for asbestos sources are a) no visible emissions to outside air <u>or</u> b) cleaning emissions prior to venting outside using fabric filters meeting specifications outlined in 61.154 subpart M, part 61, 40CFR.chapter 1.
Benzene	Operating and design requirements are outlined for fugitive emission sources of benzene. Specific requirements vary according to type of source.
Beryllium	Emissions from stationary sources must not exceed 10 g over a 24-hour period. An alternative standard (subject to approval) relates to ambient concentration which is not to exceed 0.01 $\mu g/m^3$ averaged over 1 month.
Mercury	Emissions from mercury ore processing facilities, mercury cell chloralkali plants are not to exceed 2300 g averaged over a 24-hour period. Emissions from sludge incineration plants, sludge drying plants are not to exceed 3200 g averaged over a 24-hour period.
Radionuclides	Emissions from the Department of Energy, Nuclear Regulatory Commission and Federal Facilities are not to exceed an amount causing a dose equivalent to the whole body of 25 mrem/year or 75 mrem/year to the critical organ. Radon and its

TABLE C-4 (cont'd)

U.S. National Emission Standards for Hazardous Air Pollutants

Pollutant	Emission Standards
	daughters are excluded from this standard. An alternative standard (subject to approval) relates to a non-continuous exposure not to exceed an effective dose equivalent of 500 mrem/year and a continuous exposure not to exceed an effective dose equivalent of 100 mrem/year. These emission standards apply to all sources excluding natural background and medical procedures.
Vinyl Chloride	Emissions from ethylene dichloride, vinyl chloride and polyvinyl chloride plants are not to exceed 10 ppm.

TABLE C-5

Philadelphia Ambient Air Quality Guidelines

Schedule "A"	Ambient Air Quality Guideline (Annual Average Unless Otherwise Noted) With Protocol Reference
Acrylonitrile	5 ppb, TLV/420 (II.B.)
Aldrin	0.035 $\mu g/m^3$, ADI/10 (III.D.)
4-Aminodiphenyl	0.8 $\mu g/m^3$, LEL/4200 (II.C.)
3-Amino-1,2,4-triazole	1.8 $\mu g/m^3$, LEL/1000 (II.C.)
Antimony and compounds	1.2 $\mu g/m^3$, TLV/420 (II.B.)
Arsenic and compounds	0.024 $\mu g/m^3$, PEL/420 (II.B.)
Asbestos	(0.005 fibres > 5 μm/cc), TLV/420 (II.B.)
Benzene	24 ppb, TLV/420 (II.B.)
Benzidine	30 μg/m3, LEL/1000 (II.C.)
Benzo(a)pyrene	0.0007 $\mu g/m^3$, LEL/100 (II.A.)
Beryllium and compounds	0.01 $\mu g/m^3$, (I.)
BHC	1.2 $\mu g/m^3$, TLV/420 (II.B.)
Lindane and isomers	1.2 $\mu g/m^3$, TLV/420 (II.B.)
Bis(2-chloroethyl)ether	120 ppb, TLV/42 (III.B.)
Bis(chloromethyl)ether	0.0024 ppb, TLV/420 (II.B.)
Bis(2-hydroxyethyl)-dithiocarbamic acid, potassium salt	No guideline due to insufficient scientific evidence
Cadmium and compounds	0.12 $\mu g/m^3$, TLV/420 (II.B.)
Captan	35 $\mu g/m^3$, ADI/10 (III.D.)
Carbaryl	3.5 $\mu g/m^3$, ADI/10 (III.D.)
Carbon tetrachloride	12 ppb, TLV/420 (II.B.)
Chloramben	1333 $\mu g/m^3$, LEL/4200 (II.C.)
Chlordane	0.35 $\mu g/m^3$, ADI/10 (III.D.)
Chlorobenzilate	7 $\mu g/m^3$, ADI/10 (III.D.)
Chloroform	24 ppb, TLV/420 (II.B.)
Chloromethyl methyl ether	0.02 ppb, NOEL/4200 (II.C.)
Chromium and compounds (hexavalent)	0.12 $\mu g/m^3$, TLV/420 (II.B.)
DDT/DDD	1.8 $\mu g/m^3$, ADI/10 (III.D.)
1,2-Dibromo-3-chloropropane	0.1 ppb, NOEL/1000 (II.C.)
3,3[1]-Dichlorobenzidine	No guideline due to insufficient scientific evidence; noted to be carcinogenic
2,4-Dichlorophenoxy acetic acid	105 $\mu g/m^3$, ADI/10 (III.D.)

TABLE C-5 (cont'd)

Philadelphia Ambient Air Quality Guidelines

Schedule "A"	Ambient Air Quality Guideline (Annual Average Unless Otherwise Noted) With Protocol Reference
Dieldrin	0.035 $\mu g/m^3$, ADI/10 (III.D.)
Di(2-ethyl hexyl)phthalate	120 $\mu g/m^3$, TLV/42 (III.B.)
Dimethylcarbamyl chloride	0.24 ppb, LEL/4200 (II.C.)
1,1-Dimethyl hydrazine	1.2 ppb, TLV/420 (II.B.)
Dimethyl sulfate	2.4 ppb, NOEL/420 (II.A.)
Dioxane	24 ppb, NOEL/4200 (II.C.)
Endosulfan	2.4 $\mu g/m^3$, TLV/42 (III.B.)
Endrin	0.07 $\mu g/m^3$, ADI/10 (III.D.)
Ethylenebisdithiocarbanic acid salts	18 $\mu g/m^3$, ADI/10 (III.D.)
Ethylene dibromide	2.4 ppb, LEL/4200 (II.C.)
Ethylene dichloride	37 ppb, LEL/1000 (II.C.)
Ethylene oxide	2.4 ppb, LEL/4200 (II.C.)
Ethylene thiourea	0.7 $\mu g/m^3$, ADI/10 (III.D.)
Epichlorohydrin	2.4 ppb, NOEL/4200 (II.C.)
Formaldehyde	4.8 ppb, TLV/420 (II.B.)
Heptachlor	0.18 $\mu g/m^3$, ADI/10 (III.D.)
Hexachlorobenzene	0.48 ppb, NOEL/4200 (II.C.)
Hexachlorobutadiene	0.06 ppb, NOEL/1000 (II.C.)
Hexamethyl phosphoramide	0.0024 ppb, NOEL/4200 (II.C.)
Hydrazine	0.24 ppb, TLV/420 (II.B.)
Kelthane	8.8 $\mu g/m^3$, ADI/10 (III.D.)
Kepone	0.88 $\mu g/m^3$, LEL/1000 (II.C.)
Lead and compounds	1.5 $\mu g/m^3$, (I.)
Manganese and compounds	24 $\mu g/m^3$, TLV/42 (III.B.)
Mercury and compounds	0.24 $\mu g/m^3$, TLV/42 (III.B.)
Methoxychlor	35 $\mu g/m^3$, ADI/10 (III.D.)
Methyl bromide	120 ppb, TLV/42 (III.B.)
Methyl chloride	1200 ppb, TLV/42 (III.B.)
4,4'-Methylene bis(2-chloroaniline)	0.05 ppb, TLV/420 (II.B.)
Methylene chloride	2400 ppb, TLV/42 (III.B.)
Methyl iodide	5 ppb, TLV/420 (II.B.)
Mirex	0.88 $\mu g/m^3$, LEL/1000 (II.C.)
Monomethyl hydrazine	0.5 ppb, TLV/420 (II.B.)
β-Naphthylamine	19 $\mu g/m^3$, LEL/1000 (II.C.)
Nickel and compounds	0.24 $\mu g/m^3$, TLV/420 (II.B.)
4-Nitrodiphenyl	2.7 $\mu g/m^3$, NOEL/1000 (II.C.)

TABLE C-5 (cont'd)

Philadelphia Ambient Air Quality Guidelines

Schedule "A"	Ambient Air Quality Guideline (Annual Average Unless Otherwise Noted) With Protocol Reference
Nitrofen	0.75 μg/m^3, 24-hr TWA, NOEL/1000 considering teratogenicity, (II.C.)
2-Nitropropane	6 ppb, NOEL/4200 (II.C.)
N-Nitrosodimethylamine	0.0004 ppb, NOEL/4200 (II.C.)
Parathion	1.8 μg/m^3, ADI/10 (III.D.)
Particulate polycyclic aromatic hydrocarbons	0.48 μg/m^3, TLV/420 (II.B.)
Pentachlorophenol	12 μg/m^3, TLV/42 (II.B.)
Perchloroethylene	1200 ppb, TLV/42 (III.B.)
Phenol	120 ppb, TLV/42 (III.B.)
N-Phenyl-β-Naphthylamine	45 μg/m^3, NOEL/4200 (II.C.)
Polybrominated biphenyls	No guideline due to insufficient scientific evidence
Polychlorinated biphenyls	0.18 μg/m^3, NOEL/4200 (II.C.)
Propane sultone	No guideline due to insufficient scientific evidence; noted to be highly carcinogenic
β-Propiolactone	No guideline due to insufficient scientific evidence; noted to be carcinogenic
Propylene Imine	4.8 ppb, TLV/420 (II.B.)
Propylene Oxide	250 ppb, NOEL/420 (III.C.)
Quintozene	2.4 μg/m^3, ADI/10 (III.D.)
Strobane	7.7 μg/m^3, LEL/1000 (II.C.)
2-(p-tert-Butylphenoxy) -isopropyl-2-chloroethyl sulfite	18 μg/m^3, LEL/1000 (II.C.)
Tetrachlorinated dibenzo-p-dioxins	0.000035 μg/m^3, NOEL/1000 (II.C.)
Tetrachloroethane	24 ppb, TLV/42 (III.B.)
Tetrachlorvinphos	3360 μg/m^3, LEL/1000 (II.C.)
Thallium and compounds	2.4 μg/m^3, TLV/42 (III.B.)
o-Tolidine	No guideline due to insufficient scientific evidence
Trichloroethylene	1200 ppb, TLV/42 (III.B.)
Trichlorophenol isomers	3500 μg/m^3, NOEL/100 (III.C.)
2,4,5-Trichlorophenoxy acetic acid	1 μg/m^3, ADI/10 (III.D.)
Trifluralin	1150 μg/m^3, LEL/1000 (II.C.)

TABLE C-5 (cont'd)

Philadelphia Ambient Air Quality Guidelines

Schedule "A"	Ambient Air Quality Guideline (Annual Average Unless Otherwise Noted) With Protocol Reference
Toxaphene	1.2 $\mu g/m^3$, TLV/420 (II.B.)
Vinyl bromide	12 ppb, NOEL/4200 (II.C.)
Vinyl chloride	2.4 ppb, PEL/420 (II.B.)
Vinyl cyclohexane dioxide	24 ppb, TLV/420 (II.B.)
Vinylidene chloride	6 ppb, LEL/4200 (II.C.)
Vinyl trichloride	240 ppb, TLV/42 (III.B.)

TABLE C-6

Philadelphia Guideline-Setting Methodology

I. Criteria Pollutants (as defined by EPA)
National Ambient Air Quality Standard (NAAQS), National Emissions Standard for Hazardous Air Pollutant (NESHAP), as ambients standard

II. Carcinogens (as listed by ACGIH [A1a, A1b, or A2] or by the National Toxicology Program [NTP]).

A. Human no observed effect level (NOEL) or lowest observed effect level (LOEL), inhalation, divided by 420

B. Threshold limit value (TLV) or OSHA permissible exposure limit (PEL), preferably in existence 5 years or more, divided by 420

C. Animal NOEL or LOEL, inhalation, divided by 4200 or 1000 depending on study

D. Acceptable Daily Intake (ADI), as inhalation dose, divided by 10

III. Non-Carcinogens

A. Human NOEL or LOEL, inhalation, divided by 42

B. TLV or OSHA PEL, divided by 42

C. Animal NOEL or LOEL, inhalation, divided by 420 or 100 depending on study

D. ADI, as inhalation dose, divided by 10

IV. Additional safety factor added where justified

TABLE C-7

New York Ambient Air Quality
Guidelines

TOXICITY CLASSIFICATIONS

High Toxicity Air Contaminant

Definition: Human carcinogens and other substances posing a significant risk to humans.

Chemicals Assigned to High Toxicity List

1. Human carcinogens: Those chemicals for which the induction of cancer in humans has been demonstrated.

2. Potential human carcinogens: A chemical whose 1×10^{-6} lifetime risk (as calculated using GLOBAL 82)[1] corresponds to a daily dose of 0.12 µg or less. The required experimental evidence of carcinogenicity would be in: a) Two animal species; or, b) one animal species independently reproduced; or, c) one animal species supported by "short-term tests".

3. Other substances posing a significant risk: a) Those chemicals for which significant adverse effects have been observed in humans, particularly irreversible or progressive effects; or b) Those chemicals having an acute toxicity of:
   (a) LD_{50}(oral) is equal or less than 50 mg/kg.
   (b) LC_{50}(inhalation) is equal or less than 200 ppm.[2]
   (c) LD_{50}(dermal) is equal or less than 200 mg/kg.

Moderate Toxicity Air Contaminant

Definition: Animal carcinogens, mutagens, teratogens, and other substances posing a significant risk to humans.

Chemicals Assigned to Moderate Toxicity List

1. Animal carcinogens: Those chemicals for which carcinogenicity has been demonstrated in at least one species.

2. Mutagens: Those chemicals that induce mutagenic effects (transmissible changes) in "in-vivo" or "in-vitro" tests.

3. Teratogens: Those chemicals that cause non-transmissible birth defects.

[1] Howe, R. B. and Crump, K. S., 1982 "Global 82: A computer Program to Extrapolate Qualified Animal Toxicity Data to Low Doses", Science Research Systems, Ruston, LA.

[2] When administered by continuous inhalation exposure for ONE hour (or less if death occurs within one hour) Ref: "ANSI," American National Standards Institute, Z129.1 (1982).

TABLE C-7 (contd.)

New York Ambient Air Quality Guidelines

High Toxicity Air Contaminants

Compound Chemical Name	CAS Registry Number	Threshold Limit Value(1) (TLV's) PPM	mg/m³	AAL(2) Recommended µg/m³
Acrolein	107-02-8	0.1	0.25	0.83(T)
Acrylonitrile	107-13-1	2.0	4.5	15.0(T)
Aldicarb	116-06-3	-	-	2.0(DOH/R)
p-Aminodiphenyl	92-67-1	-	-	(HAZ)(3)
Arsenic	7440-38-2	-	0.2	0.67(T)
Arsenic pentoxide	1303-28-2	-	-	see (4)
Arsenic trioxide	1327-53-3	-	-	see (4)
Asbestos(5)	1332-21-4	2 Fibers > 5 µm/cc		
Auramine	2465-27-2	-	-	see (4)
Benzene	71-43-2	10	30	100.(T)
Benzidine	92-87-5	-	-	(HAZ)
Beryllium oxide (As Beryllium, See Tables I & IA)	1304-56-9	-	.002	.007(T)
Beryllium sulfate	13510-49-1	-	.002	.007(T)
Cadmium (dust and salts) as Cd	7440-43-9	-	0.05	2.0(DOH/R)
Cadmium oxide	1306-19-0	-	0.05	0.167(T)
Cadmium sulfate	10124-36-4	-	0.005	0.167(T)
Carbon tetrachloride	56-23-5	5	30	100(T).
bis-Chloromethyl ether	542-88-1	0.001	0.005	0.017(T)(HAZ)
Chromium VI Compounds (note: CAS listed assigned to metallic chromium)	7440-47-3	-	0.05	0.167(T)
Dibromoethane (Ethylene dibromide)	106-93-4	-	-	see (4)
3,3'-Dichlorobenzidine	91-94-1	-	-	0.1(DOH/R)

TABLE C-7 (contd.)

New York Ambient Air Quality Guidelines

High Toxicity Air Contaminants (cont.)

Compound Chemical Name	CAS Registry Number	Threshold Limit Value[1] (TLV's) PPM	mg/m³	AAL[2] Recommended µg/m³
Dimethyl sulfate	77-78-1	0.1	0.5	1.67(T)
Ethyleneimine	151-56-4	0.5	1.0	3.3(T)
Ethylene oxide	75-21-8	1.0	2.0	6.67(T)
Formaldehyde	50-00-0	1	1.5	5(T)[6]
Hydrazine and its acid salts	302-01-2	0.1	0.1	0.33(T)
Lead arsenate	7784-40-9	-	0.15	0.5(T)
Methylene bisphenyl isocyanate, (Diphenylmethane-4, 4-diisocyanate) (DMI)	101-68-8	C0.02	C0.2[7]	0.67(T)
Methyl isocyanate(MIC)	624-83-9	0.02	0.05	0.17(T)
β-Naphthylamine	91-59-8	-	-	(HAZ)
Nickel (metal and insoluble compounds)	7440-02-2	-	1.0	3.3(T)
Nickel carbonyl	13463-39-3	0.05	0.35	1.17(T)
Nickel oxide	1313-99-1	-	1.0	3.37(T)
Nickel sulfide, as Ni	12035-72-2	-	1.0	0.1(DOH/R)(HAZ)
4-Nitrodiphenyl	92-93-3	-	-	(HAZ)
Nitrogen mustard	51-75-2	-	-	see (4)
Nitrosodimethylamine (dimethylnitrosoamine)	62-75-9	-	-	see (4)
Parathion	56-38-2	-	0.1	0.33(T)
Polychlorinated biphenyls (PCBs) (TLV assigned to Aroclor 1254)	1336-36-3	-	0.5	1.67(T)
Polycyclic Organic Matter[8] (includes Benzo(α)Pyrene)	50-32-8	-	-	see (4)

TABLE C-7 (contd.)

New York Ambient Air Quality Guidelines

High Toxicity Air Contaminants (cont.)

Compound Chemical Name	CAS Registry Number	Threshold Limit Value(1) (TLV's) PPM	mg/m³	AAL(2) Recommended µg/m³
2,3,7,8-Tetrachloro-dibenzofuran	51207-31-0	-	-	see (9)
Total Tetrachlorinated dibenzo-p-dioxins (includes 2,3,7,8TCDD)	1745-01-7	-	-	see (9)
Toluene-(2,4)-diisocyanate (TDI)	584-84-0	0.005	0.04	0.13(T)
Vinyl chloride (Chloroethylene)	75-01-4	-	-	0.4(DOH/R)(HAZ)
Vinylidene chloride (1,1-Dichloroethylene)	75-35-4	5	20	66.7(T)

NOTE: Radioactive materials are not included in this table as they are regulated by Part 380 of DEC's Rules and Regulations.

Footnotes:

1 1984-85 ACGIH values.

2 AAL, "Acceptable Ambient Level", source:
(T) - Interim AAL derived from ACGIH TWA-TLV
(DOH) - Contaminant specific AAL determined by NYS DOH Bureau of Toxic Substance Assessment;
(DOH/R) - Contaminant specific AAL currently under review by DOH.
(DEC) - Contaminant specific AAL determined by NYS DEC, Division of Air Resources, Bureau of Air Toxics, Toxics Assessment Section.

3 (HAZ) - "Human Carcinogens. Substances, or substances associated with industrial processesses recognized to have carcinogenic potential without an assigned TLV... for [these noted] substances,... no exposure or contact by any route - respiratory, skin or oral, as detected by the most sensitive methods - shall be permitted." From: "TLV's, Threshold Limit Values for Chemical Substances...ACGIH for 1984-85", Appendix A - Carcinogens, Table Alb., page 41.

4 No chemical specific TLV or AAL available at this time, see "High Toxicity Air Contaminants," pages 2 and 3, for guidance.

5 OSHA Temporary Standard: 0.5 fibers per c.c. (see Fed. Reg., 48, No. 215, page 51086, 1983). Not applicable to sources subject to NESHAPS.

6 Interim formaldehyde AAL of 5 µg/m³ calculated from AG-1 guidance for High Toxicity Air Contaminants, section I, paragraph B, page 3. This interim value replaces previously listed AAL of 2.0 µg/m³. NYSDOH to provide a chemical specific formaldehyde AAL by 4/1/86.

TABLE C-7 (contd.)

New York Ambient Air Quality
Guidelines

7 "C" denotes ACGIH TLV-C,"ceiling limit". "The concentration that should r be exceeded even instantaneously".

8 Containing large amounts of naphthalene, fluorene, anthracene, and acridine

9 NOTE: NYSDOH has determined that for "AAL's for dioxins... Basing acceptable ambient level on only total TCDD's as is now done in 'A Guide-1' (1984 and earlier editions) does not adequately represe public health risks for the dioxin compounds... Health risks posed emissions of chlorinated dioxins and the closely related chlorinat furans should be evaluated on a case by case basis taking ir consideration specific isomers of each family of compounds."

Based on the above statement by NYSDOH; noting the legislative manda for DOH to develop resource recovery related standards (including TCDI TCDF); and DOH's April 1, 1986 deadline for such standards, DEC withdrawing the 9.2×10^{-8} $\mu g/m^3$, "Hernandez," TCDD interim AAL* at tb time.

Emission sources of chlorinated dibenzofurans and dibenzodioxins will reviewed on a case by case basis by DOH until the standards a promulgated. Direct all inquiries on this matter to the Toxi Management Section of DEC.

* EPA's Interim Evaluation of Health Risks Associated with Emissio of Tetrachlorinated Dioxins from Municipal Waste Recove Facilities, November 1981.

TABLE C-7 (contd.)

New York Ambient Air Quality Guidelines

Moderate Toxicity Organic Air Contaminants

Compound-(ORGANICS) Chemical Name	CAS Registry Number	Threshold Limit Values[1] (TLV's) PPM	mg/m³	AAL[2] Recommended µg/m³
Acetaldehyde	75-07-0	100	180	600(T)
Acetamide	60-35-5	-	-	(DM)[3]
Acetic anhydride	108-24-7	C5[4]	C20	66.7(T)
2-Acetylaminofluorene	53-96-3	-	-	(DM)
Acrylamide	79-06-1	-	0.3	1.0(T)
Acrylic acid	79-10-3	10	30	100(T)
Allyl chloride (3-Chloro-1-propene)	107-05-1	1	3	10(T)
Aniline	62-53-3	2	10	0.4(DOH)
p-Anisidine	104-94-9	0.1	0.5	1.7(T)
Arsine	7784-42-1	0.05	0.2	0.67(T)
Benzyl chloride	100-44-7	1	5	16.7(T)
Biphenyl	92-52-4	0.2	1.5	5(T)
Butanethiol (Butyl Mercaptan)	109-79-5	0.5	1.5	5(T)
n-Butylamine	109-73-9	C5	C15	50(T)
Carbon black	1333-86-4	-	3.5	11.7(T)
Carbon disulfide	75-15-0	10	30	100(T)
Chlordane	57-74-9	-	0.5	1.7(T)
Chlordecone (Kepone)	143-50-0	-	-	(DM)
α-Chloroacetophenone (Phenacyl chloride)	532-27-4	0.05	0.3	1(T)
p-Chloroaniline	106-47-8	-	-	6.0(DOH/R)
Chlorobenzene (monochlorobenzene)	108-90-7	75	350	1167(T)
Chloroform	67-66-3	10	50	167(T)

TABLE C-7 (contd.)

New York Ambient Air Quality Guidelines

Moderate Toxicity Organic Air Contaminants (cont.)

Compound-(ORGANICS) Chemical Name	CAS Registry Number	Threshold Limit Values[1] (TLV's) PPM	mg/m³	AAL[2] Recommended µg/m³
p-Chloronitrobenzene	100-00-5	(see p-Nitrochlorobenzene below)		
o-Cresol	95-48-7	5.0	22	73(T)
m-Cresol	108-39-4	5.0	22	73(T)
p-Cresol	106-44-5	5.0	22	73(T)
Cyanamide	420-04-2	-	2	6.7(T)
Cyanides (As CN)	57-12-5	-	5	16.7(T)
Cyanic acid (Sodium Salt)	917-61-3	see Cyanogen below		
Cyanic acid (Potassium Salt)	590-28-3	see Cyanogen below		
Cyanoacetamide	107-91-5	see Cyanides above		
Cyanogen (Oxalonitrile)	460-19-5	10	20	66.7(T)
Diallylamaleate	999-21-3	-	-	6(DEC)
2,5-Diamino toluene	95-70-5	-	-	(DM)
Diazomethane	334-88-3	0.2	0.4	1.3(T)
o-Dichlorobenzene	95-50-1	C50	C300	1.000(T)
1,2-Dichloroethane (Ethylene Dichloride)	107-06-2	10	40	0.2(DOH/R)
Dichloromethane (Methylene Chloride)	75-09-2	100	350	1167.(T)
Diethyl phthalate	84-66-2	-	5	16.7(T)
Diisodecyl phthalate	26761-40-0	see Diethyl phthalate above		
3,3'-Dimethoxybenzidine (o-Dianisidine)	119-90-4	-	-	0.2(DOH/R)
4-Dimethylaminoazobenzene	60-11-7	-	-	(DM)

TABLE C-7 (contd.)

New York Ambient Air Quality Guidelines

Moderate Toxicity Organic Air Contaminants (cont.)

Compound-(ORGANICS) Chemical Name	CAS Registry Number	Threshold Limit Values[1] (TLV's) PPM	mg/m³	AAL[2] Recommended µg/m³
Dimethyl carbamoyl chloride	79-44-7	-	-	(DM)
1,1-Dimethyl hydrazine	57-14-7	0.5	1	3.3(T)
m-Dinitrobenzene	99-65-0	0.15	1	3.3(T)
Dioctyl phthalate (DOP)	117-81-7	see Diethylphthalate above		
p-Dioxane	123-91-1	25	90	300(T)
Diphenyl hydrazine	122-66-7	see Dimethyl hydrazine above		
Epichlorohydrin (1-Chloro-2,3-epoxy propane)	106-89-8	2	10	33.3(T)
Epoxypropane (Propylene oxide)	75-56-9	20	50	167(T)
Ethanethiol (Ethyl mercaptan)	75-08-1	0.5	1	3.3(T)
Ethanolamine	141-43-5	3	8	26.7(T)
Ethyl benzene	100-41-4	100	435	1450(T)
Ethyleneglycol Monopropyl ether	2807-30-9	-	-	70(DEC)
Formamide	75-12-7	20	30	100(T)
Formic acid	64-18-6	5	9	30(T)
Furfural	98-01-1	2	8	26.7(T)
Furfuryl alcohol	98-00-0	10	40	133(T)
Glycidaldehyde	765-34-4	-	-	(DM)
Heptachlor	76-44-8	-	0.5	1.7(T)
Hexachlorobenzene	118-74-1	-	-	(DM)
Hexachlorobutadiene	87-68-3	0.02	0.24	0.8(T)
Hexachlorocyclohexane (1,2,3,4,5,6, Hexachlorocyclohexane)	319-84-6	See α Lindane,		

TABLE C-7 (contd.)
New York Ambient Air Quality
Guidelines

Moderate Toxicity Organic Air Contaminants (cont.)

Compound-(ORGANICS) Chemical Name	CAS Registry Number	Threshold Limit Values[1] (TLV's) PPM	mg/m³	AAL[2] Recommended µg/m³
Hexachlorocyclopentadiene	77-47-4	0.01	0.1	0.33(T)
Hexachloronapthalene	1335-87-1	-	0.2	0.67(T)
Hexamethyl phosphoramide	680-31-9	-	-	(DM)
Hydrogen cyanide (Hydrocyanic acid)	74-90-8	C10	C10	33(T)
Hydrogen Fluoride	7664-39-3	C3	C2.5	8.3(DEC)
Hydroquinone	123-31-9	-	2	6.67(T)
Isophorone	78-59-1	C5	C25	83.3(T)
Isopropyl Alcohol[5]	67-63-0	400	980	3267(T)
Isopropylamine	75-31-0	5	12	40(T)
Ketene	463-51-4	0.5	0.9	3.33(T)
α-Lindane	319-84-6	-	0.5	1.67(T)
γ-Lindane	58-89-9	-	0.5	1.67(T)
Malathion	121-75-5	-	10	33.3(T)
Maleic anhydride	108-31-6	0.25	1	3.3(T)
Mercury (organic) (non-NESHAPS sources)	7439-97-6	-	0.05	0.167(T)
2-Methoxyethanol (Methyl cellosolve)	109-86-4	5	16	53.3(T)
Methylamine	74-89-5	10	12	40.(T)
Methyl chloromethylether	107-30-2	-	-	(DM)
4,4'-Methylene dianiline	101-77-9	0.1	0.8	2.67(T)
Methylethyl ketone (MEK)	78-93-3	200	590	1967(T)

TABLE C-7 (contd.)
New York Ambient Air Quality
Guidelines

Moderate Toxicity Organic Air Contaminants (cont.)

Compound-(ORGANICS) Chemical Name	CAS Registry Number	Threshold Limit Values[1] (TLV's) PPM	mg/m³	AAL[2] Recommended µg/m³
Methyl hydrazine (monomethyl hydrazine)	60-34-4	<0.2	<0.35	1.17(T)
Methyl isobutyl ketone	108-10-1	50	205	683(T)
Methyl mercaptan	74-93-1	0.5	1.0	3.3(T)
Methyl methacrylate	80-62-6	100	410	1367(T)
Mirex	2385-85-5	-	-	(DM)
Monochlorobenzene	108-90-7	See chlorobenzene above		
Monomethyl hydrazine	60-34-4	See methyl hydrazine above		
Naphthalene	91-20-3	10	50	166.7(T)
α-Naphthylamine	134-32-7	-	-	(DM)
Nitrilotriacetic acid	139-13-9	-	-	(DM)
p-Nitroaniline	100-01-6	-	3	6.0(DOH/R)
Nitrobenzene	98-95-3	1	5	16.7(T)
Nitroglycerine	55-63-0	0.05	0.5	16.7(T)
p-Nitrochlorobenzene	100-00-5	-	1	3.3(T)
p-Nitrophenol	100-02-7	-	-	(DM)
1-Nitropropane	108-03-2	25	90	300(T)
Nitroso-n-methylurea	684-93-5	-	-	(DM)
p-Nitrosophenol	104-91-6	-	-	(DM)
p-Nitrotoluene	99-99-0	2	11	36.7(T)
Octachloronaphthalene	2234-13-1	-	0.1	0.33(T)
Oil Mist (Mineral)	8012-95-1	-	5[6]	16.7(T)
Oxalic acid	144-62-7	-	1	3.3(T)

TABLE C-7 (contd.)

New York Ambient Air Quality Guidelines

Moderate Toxicity Organic Air Contaminants (cont.)

Compound-(ORGANICS) Chemical Name	CAS Registry Number	Threshold Limit Values[1] (TLV's) PPM	mg/m³	AAL[2] Recommended µg/m³
Paraquat	1910-42-5	-	0.1	0.33(T)
Pentachlorophenol	87-86-5	-	0.5	1.67(T)
Perchloroethylene	127-18-4	See tetrachloroethylene below		
Petroleum distillates	8002-05-9	-	-	(DM)
Phenol	108-95-2	5	19	10.0(DOH)
p-Phenylene diamine	106-50-3	-	0.1	0.33(T)
Phenylhydrazine	100-63-0	5	20	66.7(T)
Phosgene	75-44-5	0.1	0.4	1.33(T)
Phosphine	7803-51-2	0.3	0.4	1.33(T)
Picric acid	88-89-1	-	0.1	0.33(T)
Propane sultone	1120-71-4	-	-	(DM)
β-Propiolactone	57-57-8	0.5	1.5	5.0(T)
Pyrethrin	121-29-9	See Pyrethrum		
Pyrethrum	8003-34-7	-	5.	16.7(T)
Quinoline	91-22-5	-	-	(DM)
Quinone	106-51-4	0.1	0.4	1.33(T)
Rotenone (commercial)	83-79-4	-	5	1.67(T)
Styrene, monomer	100-42-5	50	215	716(T)
1,1,2,2-Tetrachloroethane	79-34-5	1	7	23.3(T)
Tetrachloroethylene (Perchloroethylene)	127-18-4	50	335	1116(T)
Thiourea	62-56-6	-	-	(DM)
Toluene-(2,4)-diamine	95-80-7	-	-	(DM)

TABLE C-7 (contd.)

New York Ambient Air Quality Guidelines

Moderate Toxicity Organic Air Contaminants (cont.)

Compound-(ORGANICS) Chemical Name	CAS Registry Number	Threshold Limit Values[1] (TLV's) PPM	mg/m³	AAL[2] Recommended µg/m³
o-Toluidine	95-53-4	2	9	30(T)
Toxaphene (chlorinated camphene)	8001-35-2	-	0.5	1.67(T)
1,2,4-Trichlorobenzene	120-82-1	C5	C40	133(T)
1,1,2-Trichloroethane	79-00-5	10	45	150(T)
Trichloroethylene	79-01-6	50	270	900(T)
Urethane (Carbamic acid)	51-79-6	-	-	(DM)
Vinyl bromide	593-60-2	5	20	66.7(T)
Vinyl fluoride	75-02-2	See Vinyl bromide		
o-Xylene (note: CAS 1300-20-7 assigned to mixed isomer xylenes)	95-47-6	100	435	1450(T)
m-Xylene	108-38-3	100	435	1450(T)
p-Xylene	106-42-3	100	435	1450(T)
Xylidine	1300-73-8	2.0	10	33.3 (T)

TABLE C-7 (contd.)

New York Ambient Air Quality Guidelines

Moderate Toxicity Inorganic Air Contaminants

Compound-(INORGANICS) Chemical Name	CAS Registry Number	Threshold Limit Values[1] (TLV's) PPM	mg/m³	AAL[2] Recommended µg/m³
Ammonium bromide	12124-97-9	-	-	30.0(DEC)
Antimony	7440-36-0	-	0.5	0.67(T)
Antimony trioxide	1309-64-4	-	0.5	0.67(T)
Barium	7440-39-3	-	0.5	0.67(T)
Barium sulfate	7727-43-7	-	-	(DM)
Bromine	7726-95-6	0.1	0.7	2.33(T)
Cadmium chloride (as Cd salt)	10108-64-2	-	0.05	1.67(T)
Chlorine	7782-50-5	1	3	10(T)
Chlorine dioxide	10049-04-4	0.1	0.3	1(T)
Cobalt	7440-48-4	-	0.1	0.33(T)
Cobalt oxide	1307-96-6	-	-	(DM)
Cobalt sulfide	1317-42-6	-	-	(DM)
Fluorine	7782-41-4	1	2	6.7(T)
Lead acetate	1335-32-6	-	-	(DM)
Mercury (inorganic) (non-NESHAPS sources)	7439-97-6	-	0.1	0.33(T)
Phosphorous (yellow)	7723-14-0	-	0.1	0.33(T)
Selenium	7782-49-2	-	0.2	0.66(T)
Selenium sulfide	7488-56-4	-	0.2	0.66(T)
Thallium[7]	7440-28-0	-	0.1	0.33(T)
Thallium oxide	1314-32-5	-	0.1	0.33(T)

TABLE C-7 (contd.)

New York Ambient Air Quality
Guidelines

Moderate Toxicity Inorganic Air Contaminants (cont.)

Compound-(INORGANICS) Chemical Name	CAS Registry Number	Threshold Limit Values[1] (TLV's) PPM	mg/m³	AAL[2] Recommended µg/m³
Thallium (I) selenite	12039-52-0	-	0.1	0.33(T)
Thallium sulfate	7446-18-6	-	0.1	0.33(T)
Zinc bromide	7699-45-8	-	-	3.0(DEC)
Zinc chloride (fume)	7646-85-7	-	1	3.3(T)
Zinc oxide (fume)	1314-13-2	-	5	16.7(T)

(1) 1984-85 ACGIH values.

(2) AAL, "Acceptable Ambient Level," source:
(T) - Interim AAL derived from ACGIH TWA-TLV, see text, page 4.
(DOH) - Contaminant specific AAL determined by NYS DOH, Bureau of Toxic Substance Assessment;
(DOH/R) - Contaminant specific AAL currently under review by DOH.
(DEC) Contaminant specific AAL determined by NYS DEC, Division of Air Resources, Bureau of Air Toxics, Toxics Assessment Section.

(3) (DM) denotes "de minimus" Interim AAL of 0.03 µg/m³ is recommended for use with Appendix A screening methodology. No chemical specific TLV or AAL is available at this time.

(4) "C" denotes ACGIH TLV-C, "ceiling limit". "The concentration that should not be exceeded even instantaneously."

(5) The higher degree of toxicity is due to isopropyl oil, a common manufacturing by-product.

(6) Oil Mist (mineral) as sampled by a method which does not collect vapor.

(7) The TLV of 0.1 mg/m³ is for soluble thallium compounds, as Tl. Thallium readily oxidizes in air at room temperature.

TABLE C-7 (contd.)

New York Ambient Air Quality Guidelines

Low Toxicity Organic Air Contaminants

Compound-(ORGANICS) Chemical Name	CAS Registry Number	Threshold Limit Values[1] (TLV's) PPM	mg/m³	AAL[2] Recommended µg/m³
Acetone	67-64-1	750	1780	35600(T)*
Acetonitrile	75-05-8	40	70	1400(T)
n-Butyl acetate	123-86-4	150	710	14200(T)
n-Butyl alcohol	71-36-3	C50[3]	C150	3000(T)
Butyl benzyl phthalate	85-68-7	-	5[4]	100(T)
Chloromethane (Methyl chloride)	74-87-3	50	105	2100(T)
Cyclohexane	110-82-7	300	1050	21000(T)
Diethyl ether (1,1'-Oxybis-ethane)	60-29-7	(See Ethyl ether, below)		
Dioctyl sebacate	122-62-3	-	-	80.0(DEC)
Ethyl acetate	141-78-6	400	1400	28000(T)
Ethyl chloride	75-00-3	1000	2600	52000(T)
Ethyl ether (Diethyl ether, ethers)	60-29-7	400	1200	24000(T)
Glycerin Mist[5]	56-81-5	-	10	200(T)
Glycol monoethylether (2-Ethoxyethanol)	110-80-5	5	9	180(T)
n-Heptane	142-82-5	400	1600	32000(T)
Isoamyl acetate	123-92-2	100	525	10500(T)
Isoamyl alcohol	123-51-3	100	360	7200(T)
Isobutyl acetate	110-19-0	150	700	14000(T)
Pyridine	110-86-1	5	15	2.0(DOH/R)
Resorcinol	108-46-3	10	45	900(T)

TABLE C-7 (contd.)

New York Ambient Air Quality Guidelines

Low Toxicity Organic Air Contaminants (cont.)

Compound-(ORGANICS) Chemical Name	CAS Registry Number	Threshold Limit Values[1] (TLV's) PPM	mg/m³	AAL[2] Recommended µg/m³
Tetrahydrofuran	109-99-9	200	590	11800(T)
Toluene (Toluol)	108-88-3	100	375	7500(T)
1,1,1-Trichloroethane (Methyl chloroform)	71-55-6	350	1900	38000(T)
Turpentine	8006-64-2	100	560	11200(T)
Urea	57-13-6	-	-	(DM)

NOTE: 1000 $\mu g/m^3$ = 1 mg/m^3

TABLE C-7 (contd.)

New York Ambient Air Quality
Guidelines

Low Toxicity Inorganic Air Contaminants

Compound-(INORGANICS) Chemical Name	CAS Registry Number	Threshold Limit Values[1] (TLV's) PPM	mg/m³	AAL[2] Recommended µg/m³
Ammonia	7664-41-7	25	18	360(T)
Copper, (fume)	7440-50-8	-	0.2	4(T)
Copper, (dusts and mists, as Cu)	7440-50-8	-	1	20(T)
Hydrogen bromide	10035-10-6	C3	C10	200(T)
Hydrogen chloride	7647-01-0	C5	C7	140(T)
Iodine	7553-56-2	C0.1	C1	20(T)
Nitric acid	7697-37-2	2	5	100(T)
Zinc	7440-66-6	-	-	(DM)[6]

(1) 1984-85 ACGIH values.

(2) AAL, "Acceptable Ambient Level," source:
(T) - Interim AAL derived from ACGIH TWA-TLV.
(DOH) - Contaminant specific AAL determined by NYS DOH, Bureau of Toxic Substance Assessment;
(DOH/R) - Contaminant specific AAL currently under review by DOH.
(DEC) - Contaminant specific AAL determined by NYS DEC, Division of Air Resources, Bureau of Air Toxics, Toxics Assessment Section.

(3) "C" denotes ACGIH TLV-C, "ceiling limit". "The concentration that should not be exceeded even instantaneously." - 1984-85 ACGIH TLV booklet.

(4) TLV assigned to Diethyl phthalate.

(5) See "Appendix D - Some Nuisance Particulates," page 50; and "Notice of Intended Changes (for 1984-85)", page 36 and especially page 40 ("Generic Listing"), of the 1984-85 ACGIH TLV booklet.

(6) (DM) denotes "de minimus" Interim AAL of 0.03 $\mu g/m^3$ is recommended for use with Appendix A screening methodology. No chemical specific TLV or AAL is available at this time.

TABLE C-8

Compound Classification Used in California

Preliminary Compound Ranking

Level 1A

Asbestos, Benzene, Cadmium, Carbon Tetrachloride, Chloroform, Chromium, Ethylene Dibromide, Ethylene Dichloride, Ethylene Oxide, Formaldehyde, Inorganic Arsenic, Nickel, PAH, Polychlorinated Biphenyls, PCD-Dioxins, Vinyl Chloride

Level 1B

Inorganic Lead, Manganese, Methyl Chloroform, Methylene Chloride, Perchloroethylene, Radionuclides, Trichloroethylene

Level 2

Acetaldehyde, Acrolein, Acrylonitrile, Allyl Chloride, Benzl Chloride, Beryllium, Chlorobenzene, Chloroprene, Cresol, p-Dichlorobenzene, Dialkyl Nitrosamines, 1,4-Dioxane, Epichlorohydrin, Hexachlorocyclopentadiene, Maleic Anhydride, Methyl Bromide, Mercury, Nitrobenzene, Nitrosomorpholine, Phenol and Chlorinated Phenols, Phosgene, Propylene Oxide, Vinylidene Chloride, Xylene

TABLE C-9

Unit Risk Factors for Known and Suspected Carcinogens Developed by the State of Kentucky

	Unit risk factors
Acrylonitrile	6.86×10^{-5}
Aflatoxin B_1	8.29×10^{-1}
Aldrin	5.5×10^{-8}
Ally chloride	3.40×10^{-6}
Arsenic	4.29×10^{-3}
B[a]P	3.29×10^{-3}
Benzene	8.29×10^{-6}
Benzidene	6.69×10^{-2}
Beryllium	7.4×10^{-4}
1,3-Butadiene	4.6×10^{-5}
Cadmium	2.3×10^{-3}
Carbon tetrachloride	1.5×10^{-5}
Chlordane	4.60×10^{-4}
Chlorinated ethanes	
1,2-Dichloroethane	7.0×10^{-6}
hexachloroethane	4.0×10^{-6}
1,1,2,2-Tetrachloroethane	5.7×10^{-5}
1,1,2-Trichloroethane	1.64×10^{-5}
Chloroform	1.0×10^{-5}
Chromium VI	1.2×10^{-2}
Dichlorobenzidine	4.83×10^{-4}
1,1-Dichloroethylene (Vinylidene Chloride)	3.31×10^{-4}
Dichloromethane (Methylene chloride)	1.80×10^{-7}
Dieldrin	8.69×10^{-3}
2,4-Dinitrotoluene	8.86×10^{-5}
Diphenylhydrazine	2.20×10^{-4}
Epichlorohydrin	2.83×10^{-6}
Bis(2-chloroethyl)ether	3.26×10^{-4}
Bis(chloromethyl)ether	2.66
Ethylene dibromide (EDB)	5.1×10^{-4}

TABLE C-9 (contd.)

Unit Risk Factors for Known and Suspected Carcinogens Developed by the State of Kentucky

Ethylene oxide	1.00×10^{-4}
Formaldehyde	6.1×10^{-6}
Heptachlor	9.63×10^{-4}
Hexachlorobenzene	4.9×10^{-4}
Hexachlorobutadiene	2.21×10^{-5}
Hexachlorocyclohexane	
technical grade	1.36×10^{-3}
alpha isomer	3.18×10^{-3}
beta isomer	5.26×10^{-4}
gamma isomer	3.80×10^{-4}
Hexachlorodibenzodioxin	1.77
Melamine	4.1×10^{-7}
Methyl chloride	1.4×10^{-7}
Methylene chloride	1.8×10^{-7}
4,4'-Methylene dianiline	2.1×10^{-5}
Nickel	3.3×10^{-4}
Nitrobenzene	1.2×10^{-3}
Nitrosomorpholine	1.5×10^{-5}
Nitrosamines	
Dimethylnitrosamine	7.40×10^{-3}
Diethylnitrosamine	1.24×10^{-2}
Dibutylnitrosamine	1.55×10^{-3}
N-nitrosopyrrolidine	6.09×10^{-4}
N-nitroso-N-ethylurea	9.40×10^{-3}
N-nitroso-N-methylurea	8.65×10^{-2}
N-nitroso-diphenylamine	1.41×10^{-6}
PCBs	1.24×10^{-3}
Pentachlorophenol	3.9×10^{-7}
Perchloroethylene	1.7×10^{-6}
Propylene dichloride	7.2×10^{-7}
Propylene oxide	1.2×10^{-4}
Phenols	
2,4,6-Trichlorophenol	5.69×10^{-6}
Styrene	2.9×10^{-7}
Tetrachlorodibenzo-p-dioxin (TCDD)	44.57

TABLE C-9 (cont'd.)

Unit Risk Factors for Known and Suspected Carcinogens Developed by the State of Kentucky

Tetrachloroethylen	1.46×10^{-5}
Terephthalic acid	1.8×10^{-8}
Titanium dioxide	5.6×10^{-7}
Toxaphene	3.23×10^{-4}
Trichloroethylene	4.1×10^{-6}
Vinyl chloride	5.00×10^{-6}
Vinylidene chloride	4.2×10^{-5}

TABLE C-10

Compounds and the Concentration in Waste
at which they are Considered Hazardous -
State of Illinois

Constituent	Significant Concentration Percentages are by weight
Acetonitrile	35 mg/l
Acetophenone	NE[1]
3-(α-Acetonylbenzyl)-4-hydroxycoumarin and salts (Warfarin)	6%
2-Acetylaminofluorene	*[2]
Acetyl chloride	NE
1-Acetyl-2-thiourea	100%
Acrolein	4%
Acrylamide	NE
Acrylonitrile	10 mg/l*
Aflatoxins	*
Aldrin	15%
Allyl alcohol	12.8%
Aluminum phosphide	20%

[1] NE denotes that a significant concentration of the constituent has not been established. For such a waste to be deemed hazardous when incinerated, the constituent must be present at 100%.

[2] * indicates that the constituent is a carcinogen listed by the National Toxicology Program (NTP). If the constituent is present in a waste to be incinerated at an amount equal to or greater than the significant amount, then the waste must be incinerated in accordance with requirements of 35 Ill. Adm. Code 724: Subpart O. If no significant concentration is established for the carcinogen, it is regulated under 35 Ill. Adm. Code 809: Subpart J.

TABLE C-10 (contd.)

Compounds and the Concentration in Waste at which they are Considered Hazardous - State of Illinois

4-Aminobiphenyl	*
6-Amino-1,1a,2,8,8a,8b-hexahydro-8-(hydroxymethyl)-8a-methoxy-5-methylcarbamate azirino (2',3':3,4) pyrrolo (1,2a)indole-4,7-dione (ester) (Mitomycin C)	NE
5-(Aminomethyl)-3-isoxazolol	90%
4-Aminopyridine	42%
Amitrole	*
Aniline	NE
Antimony and compounds, N.O.S.[3]	NE
Aramite	*
Arsenic and compounds, N.O.S.	0.63% *
Arsenic acid	NE
Arsenic pentoxide	*
Arsenic trioxide	*
Auramine	*
Azaserine	NE
Barium and compounds, N.O.S.	NE
Barium cyanide	NE
Benz(c)acridine	NE
Benz(a)anthracene	1.25 mg/kg (dry wt.)*

[3] The abbreviation N.O.S. (not otherwise specified) signifies those members of the general class not specifically listed by name.

TABLE C-10 (contd.)

Compounds and the Concentration in Waste at which they are Considered Hazardous - State of Illinois

Benzene	*
Benzenearsonic acid	NE
Benzene, dichloromethyl(Benzal chloride)	NE
Benzenethiol	92%
Benzidine	*
Benzo(b)fluoranthene	*
Benzo(j)fluoranthene	NE
Benzo(a)pyrene	5.98 mg/kg (dry wt.)*
p-Benzoquinone	NE
Benzotrichloride	1%
Benzyl chloride	10%
Beryllium and compounds, N.O.S.	*
Bis(2-chloroethoxy)methane	NE
Bis(2-chloroethyl)ether	14%
N,N-Bis(2-chloroethyl)2-naphthylamine	*
Bis(2-chloroisopropyl) ether	NE
Bis(chloromethyl) ether	3.5% *
Bis(2-ethylhexyl) phthalate	NE
Bromoacetone	NE
Bromomethane	NE
4-Bromophenyl phenyl ether	NE
Brucine	2%
2-Butanone peroxide	2%
Butyl benzyl phthalate	NE

TABLE C-10 (contd.)

Compounds and the Concentration in Waste at which they are Considered Hazardous - State of Illinois

2-sec-Butyl-4,6-dinitrophenol (DNBP)	50%
Cadmium and compounds, N.O.S.	280 ppm *
Calcium chromate	*
Calcium cyanide	78%
Carbon disulfide	14%
Carbon oxyfluoride	NE
Chloral (acetaldehyde, trichloro-)	NE
Chlorambucil	*
Chlordane (α and gamma isomers)	NE
Chlorinated benzenes, N.O.S.	NE
Chlorinated ethane, N.O.S.	NE
Chlorinated fluorocarbons, N.O.S.	10%
Chlorinated naphthalene, N.O.S.	NE
Chlorinated phenol, N.O.S.	NE
Chloroacetaldehyde	46%
Chloroalkyl ethers, N.O.S.	NE
p-Chloroaniline	NE
Chlorobenzene	10%
Chlorobenzilate	NE
p-Chloro-m-cresol	NE
1-Chloro-2,3-epoxypropane	2%
2-chloro-1,3 butadiene (chloroprene)	NE
2-Chloroethyl vinyl ether	NE
3-chloropropene (allyl chloride)	NE
Chloroform	0.8% *
Chloromethane	NE
Chloromethyl methyl ether	NE

TABLE C-10 (contd.)

Compounds and the Concentration in Waste at which they are Considered Hazardous - State of Illinois

2-Chloronaphthalene	NE
2-Chlorophenol	12.0 mg/kg (dry wt.)
1-(o-Chlorophenyl)thiourea	9 .2%
3-Chloropropionitrile	100%
Chromium and compounds, N.O.S.	150 ppm *
Chrysene	2.06 mg/kg (dry wt.)
Citrus red No. 2	NE
Coal tars	NE
Copper cyanide	NE
Creosote	NE
Cresols	5%
Crotonaldehyde	NE
Cyanides (soluble salts and complexes), N.O.S.	38 ppm
Cyanogen	NE
Cyanogen bromide	NE
Cyanogen chloride	59%
Cycasin	*
2-Cyclohexyl-4,6-dinitrophenol	50%
Cyclophosphamide	*
Daunomycin	NE
DDD (dichlorodiphenyldichloroethane)	NE
DDE (ethylene,1,1-dichloro-2,2-bis (4-chlorophenol-))	NE
DDT (dichlorodiphenyltrichloroethane)	NE

TABLE C-10 (contd.)

Compounds and the Concentration in Waste at which they are Considered Hazardous - State of Illinois

Diallate	NE
Dibenz(a,h)acridine	*
Dibenz(a,j)acridine	*
Dibenz(a,h)anthracene	*
7H-Dibenzo(c,g)carbazole	*
Dibenzo(a,e)pyrene	NE
Dibenzo(a,h)pyrene	*
Dibenzo(a,i)pyrene	*
1,2-Dibromo-3-chloropropane	*
1,2-Dibromoethane	*
Dibromomethane	NE
Di-n-butyl phthalate	NE
o-dichlorobenzene	10%
m-Dichlorobenzene,	NE
p-Dichlorobenzene	NE
3,3'-Dichlorobenzidine	*
1,4-Dichloro-2-butene	NE
Dichlorodifluoromethane	NE
1,1-Dichloroethane	NE
1,2-Dichloroethane	17% *
trans-1,2-Dichloroethene	NE
Dichloroethylene, N.O.S.	NE
1,1-Dichloroethylene	NE
Dichloromethane	NE
2,4-Dichlorophenol	NE

TABLE C-10 (contd.)

Compounds and the Concentration in Waste at which they are Considered Hazardous - State of Illinois

2,6-Dichlorophenol	NE
2,4-Dichlorophenoxyacetic acid (2,4-D)	NE
Dichlorophenylarsine	NE
Dichloropropane, N.O.S.	NE
1,2-Dichloropropane	NE
Dichloropropanol, N.O.S.	10%
Dichloropropene, N.O.S.	NE
1,3-Dichloropropene	NE
Dieldrin	92%
1,2:3,4-Diepoxybutane	*
Diethylarsine	NE
N,N-Diethylhydrazine	NE
O,O-Diethyl-S-methyl ester of phosphorodithioic acid	NE
O,O-Diethylphosphoric acid, O-p-nitrophenyl ester	NE
Diethyl phthalate	NE
O,O-Diethyl-O-(2-pyrazinyl)phosphorothioate	7%
Diethylstilbestrol	*
Dihydrosafrole	NE
3,4-Dihydroxy-α-(methylamino)-methyl benzyl alcohol	NE
Di-isopropylfluorophosphate (DFP)	12%
Dimethoate	60%
3,3'-Dimethoxybenzidine	*

TABLE C-10 (contd.)

Compounds and the Concentration in Waste at which they are Considered Hazardous - State of Illinois

p-Dimethylaminoazobenzene	*
7,12-Dimethylbenz(a)anthracene	NE
3,3'-Dimethylbenzidine	*
Dimethylcarbamoyl chloride	*
1,1-Dimethylhydrazine	NE
1,2-Dimethylhydrazine	NE
3,3-Dimethyl-1-(methylthio)-2-butanone	17%
α,α-Dimethylphenethylamine	50%
2,4-Dimethylphenol	3.4 mg/kg (dry wt.)
Dimethyl phthalate	NE
Dimethyl sulfate	*
Dinitrobenzene, N.O.S.	NE
4,6-Dinitro-o-cresol and salts	66%
2,4-Dinitrophenol	60%
2,4-Dinitrotoluene	NE
2,6-Dinitrotoluene	NE
Di-n-octyl phthalate	NE
1,4-Dioxane	*
Diphenylamine	NE
1,2-Diphenylhydrazine	NE
Di-n-propylnitrosamine	NE
Disulfoton	5%
2,4-Dithiobiuret	10%
Endosulfan	36%
Endrin and metabolites	6%

TABLE C-10 (contd.)

Compounds and the Concentration in Waste at which they are Considered Hazardous - State of Illinois

Ethyl carbamate	NE
Ethyl cyanide	78%
Ethylenebisdithiocarbamic acid, salts and esters	NE
Ethyleneimine	30%
Ethylene oxide	NE
Ethylenethiourea	*
Ethyl methacrylate	NE
Ethyl methanesulfonate	NE
Fluoranthene	NE
Fluorine	92.5%
2-Fluoroacetamide	11.5%
Fluoroacetic acid, sodium salt	0.44%
Formaldehyde	*
Formic acid	NE
Glycidylaldehyde	NE
Halomethane, N.O.S.	NE
Heptachlor	80%
Heptachlor epoxide (α, β, and gamma isomers)	NE
Hexachlorobenzene	20.0% *
Hexachlorobutadiene	33.8%
Hexachlorocyclohexane (all isomers)	*
Hexachlorocyclopentadiene	NE
hexachlorodibenzo-p-dioxins	1.0 ppm
hexachlorodibenzofurans	9.0 ppm
Hexachloroethane	4%

TABLE C-10 (contd.)

Compounds and the Concentration in Waste
at which they are Considered Hazardous -
State of Illinois

1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-1,4:5,8-endo,endo-dimethanonaphthalene	14%
Hexachlorophene	NE
Hexachloropropene	NE
Hexaethyl tetraphosphate	10%
Hydrazine	*
Hydrocyanic acid	225 mg/l
Hydrofluoric acid	NE
Hydrogen sulfide	NE
Hydroxydimethylarsine oxide (cacodylic acid)	NE
Indeno(1,2,3-cd)pyrene	*
Iodomethane	NE
Iron Dextran	*
Isobutyl alcohol	10%
Isocyanic acid, methyl ester	2.5%
Isosafrole	NE
Kepone	*
Lasiocarpine	NE
Lead and compounds, N.O.S.	580 mg/kg (dry wt.)
Lead acetate	*
Lead phosphate	*
Lead subacetate	NE
Maleic anhydride	NE

TABLE C-10 (contd.)

Compounds and the Concentration in Waste
at which they are Considered Hazardous -
State of Illinois

Maleic hydrazide	NE
Malononitrile	NE
Melphalan	*
Mercury and compounds, N.O.S.	NE
Mercury fulminate	NE
Methacrylonitrile	NE
Methanethiol	NE
Methapyrilene	NE
Methomyl	34%
Methoxychlor	NE
2-Methylaziridine	38%
3-Methylcholanthrene	NE
Methylchlorocarbonate	NE
4,4'-Methylene-bis-(2-chloroaniline)	*
Methyl ethyl ketone (MEK)	10%
Methyl hydrazine	37%
2-Methyllactonitrile	31.5%
Methyl methacrylate	NE
Methyl methanesulfonate	NE
2-Methyl-2-(methylthio)propionaldehyde-o-(methylcarbonyl) oxime	2%
N-Methyl-N'-nitro-N-nitrosoguanidine	NE
Methyl parathion	18%
Methylthiouracil	NE
Mustard gas	*

TABLE C-10 (contd.)

Compounds and the Concentration in Waste at which they are Considered Hazardous - State of Illinois

Naphthalene	1200 ppm
1,4-Naphthoquinone	NE
1-Naphthylamine	NE
2-Naphthylamine	*
1-Naphthyl-2-thiourea	12%
Nickel and compounds, N.O.S.	*
Nickel carbonyl	17.5% *
Nickel cyanide	NE
Nicotine and salts	25%
Nitric oxide	NE
p-Nitroaniline	NE
Nitrobenzene	5%
Nitrogen dioxide	NE
Nitrogen mustard and hydrochloride salt	NE
Nitrogen mustard N-oxide and hydrochloride salt	NE
Nitroglycerine	5%
4-Nitrophenol	NE
4-Nitroquinoline-1-oxide	NE
Nitrosamine, N.O.S.	NE
N-Nitrosodiethanolamine	*
N-Nitrosodiethylamine	*
N-Nitrosodimethylamine	39.0% *
N-Nitrosodi-N-propylamine	*
N-Nitroso-N-ethylurea	*

TABLE C-10 (contd.)

Compounds and the Concentration in Waste at which they are Considered Hazardous - State of Illinois

N-Nitrosomethylethylamine	NE
N-Nitroso-N-methylurea	*
N-Nitroso-N-methylurethane	NE
N-Nitrosomethylvinylamine	*
N-Nitrosomorpholine	*
N-Nitrosonornicotine	*
N-Nitrosopiperidine	*
N-Nitrosopyrrolidine	*
N-Nitrososarcosine	*
5-Nitro-o-toluidine	NE
Octamethylpyrophosphoramide	10%
Osmium tetroxide	28%
7-Oxabicyclo(2.2.1)heptane-2,3-dicarboxylic acid (Endothal)	76%
Paraldehyde	79%
Parathion	20%
Pentachlorobenzene	NE
pentachlorodibenzo-p-dioxins	NE
pentachlorodibenzofurans	0.12 ppm
Pentachloroethane	NE
Pentachloronitrobenzene (PCNB)	NE
Pentacholorophenol	4.8 mg/kg (dry wt.)
Phenacetin	*
Phenol	4.5 mg/kg (dry wt.)
Phenylenediamine	NE
Phenylmercury acetate	60%
N-Phenylthiourea	6%

TABLE C-10 (contd.)

Compounds and the Concentration in Waste
at which they are Considered Hazardous -
State of Illinois

Phosgene (carbonyl chloride)	NE
Phosphine	5.5%
Phosphorodithioic acid, O,O-diethyl S((ethylthio)methyl)ester (Phorate)	5%
Phosphorothioic acid, O,O-dimethyl, O-(p-((dimethylamine)sulfonyl)phenyl) ester (Famphur)	70%
Phthalic acid esters, N.O.S.	NE
Phthalic anhydride	NE
2-Picoline	7%
Polychlorinated biphenyl, N.O.S.	*
Potassium cyanide	NE
Potassium silver cyanide	42%
Pronamide	NE
1,3-Propane sultone	NE
n-Propylamine	NE
Propylthiouracil	NE
2-Propyn-1-ol	0.14%
Pyridine	10%
Reserpine	*
Resorcinol	NE
Saccharin and salts	*
Safrole	*
Selenious acid	NE
Selenium and compounds, N.O.S.	NE

TABLE C-10 (contd.)

Compounds and the Concentration in Waste at which they are Considered Hazardous - State of Illinois

Selenium sulfide	*
Selenourea	100%
Silver and compounds, N.O.S.	NE
Silver cyanide	NE
Sodium cyanide	NE
Streptozotocin	*
Strontium sulfide	32%
Strychnine and salts	30%
1,2,4,5-Tetrachlorobenzene	NE
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	*
tetrachlorodibenzo-p-dioxins	100 ppm
tetrachlorodibenzofurans	0.12 ppm
Tetrachloroethane, N.O.S.	NE
1,1,1,2-Tetrachloroethane	6.3%
1,1,2,2-Tetrachloroethane	23%
Tetrachloroethylene (Perchloroethylene)	NE
Tetrachloromethane (Carbon tetrachloride)	*
2,3,4,6-Tetrachlorophenol	NE
Tetraethyldithiopyrophosphate	10%
Tetraethyl lead	29%
Tetraethylpyrophosphate	2.4%
Tetranitromethane	NE
Thallium and compounds, N.O.S.	NE
Thallic oxide	44%
Thallium (I) acetate	NE
Thallium (I) carbonate	NE
Thallium (I) chloride	NE

TABLE C-10 (contd.)

Compounds and the Concentration in Waste at which they are Considered Hazardous - State of Illinois

Thallium (I) nitrate	NE
Thallium selenite	NE
Thallium (I) sulfate	31.6%
Thioacetamide	*
Thiosemicarbazide	18.3%
Thiourea	*
Thiuram	NE
Toluene	10%
Toluene diamine	NE
o-Toluidine hydrochloride	*
Tolylene diisocyanate	3%
Toxaphene	1.0% *
Tribomomethane	NE
1,2,4-Trichlorobenzene	NE
1,1,1-Trichloroethane	10%
1,1,2-Trichloroethane	31%
Trichloroethene (Trichloroethylene)	NE
Trichloromethanethiol	NE
Trichloromonofluoromethane	10%
2,4,5-Trichlorophenol	NE
2,4,6-Trichlorophenol	*
2,4,5-Trichlorophenoxyacetic acid (2,4,5-T)	NE
2,4,5-Trichlorophenoxypropionic acid (2,4,5-TP) (Silvex)	NE
Trichloropropane, N.O.S.	70%

TABLE C-10 (contd.)

Compounds and the Concentration in Waste at which they are Considered Hazardous - State of Illinois

1,2,3-Trichloropropane	NE
O,O,O-Triethyl phosphorothioate	NE
sym-Trinitrobenzene	NE
Tris(1-azridinyl)phosphine sulfide	*
Tris(2,3-dibromopropyl) phosphate	*
Trypan blue	NE
Uracil mustard	NE
Vanadic acid, ammonium salt	36%
Vanadium pentoxide	20%
Vinyl chloride	*
Zinc cyanide	NE
Zinc phosphide	80%

PMP:mgg/sp/1030d/1-17

TABLE C-11

Compounds Proposed for Regulation by
the State of Colorado

ACETALDEHYDE
ACETONE
ARSENIC
ASBESTOS
BENZENE
BERYLLIUM
N-BUTYL ACETATE
N-BUTYL ALCOHOL
CADMIUM
CARBON DISULFIDE
CARBON TETRACHLORIDE
CHLORDANE
CHLORINE
CHROMIUM
CYANIDE
o-DICHLOROBENZENE
p-DICHLOROBENZENE
DICHLOROETHANE
DIETHYL ETHER
ETHYL ACETATE
ETHYL CHLORIDE
ETHYLENE DICHLORIDE
ETHYLENE OXIDE
FLUORINE
FORMALDEHYDE
FORMIC ACID
FURAN
FURFURAL
GLYCERINE
HEXACHLOROBENZENE
HYDROGEN CHLORIDE
HYDROGEN FLUORIDE
HYDROGEN SULFIDE
ISOPROPYL ALCOHOL
KETONE
LEAD
MERCURY
METHYL ALCOHOL
METHYL CELLOSOLVE
METHYL CHLOROFORM
(1,1,1-TRICHLOROETHANE)
METHYLENE CHLORIDE
(DICHLOROMETHANE)
METHYL ETHYL KETONE
METHYL ISOCYANATE
METHYL MERCAPTAN
MONOCHLOROBENZENE
NAPTHALENE
NICKEL
NITRIC ACID
PERCHLOROEHTYLENE
PETROLEUM DISTILLATES
PHENOL
PHOSGENE
POLYCHLORINATED BIPHENYLS (PCB)
POLYCYCLIC ORGANIC MATTER
RADIONUCLIDES
STYRENE, MONOMER
1,1,2,2-TETRACHLOROETHANE
TETRAHYDROFURAN
TOLUENE
TOLUENE-(2,4)-DIAMINE
TOLUENE-(2,4,)-DIISOCYANATE
1,1,1-TRICHLOROETHANE
1,1,2-TRICHLOROETHANE
TRICHLOROETHYLENE
VINYL CHLORIDE
O,M,P-XYLENE

APPENDIX D

REGULATORY REQUIREMENTS - EUROPE

D-1 INTRODUCTION

This appendix provides a general overview of emission standards applicable to hazardous waste incineration facilities in a number of European jurisdictions.

D-2 EUROPEAN REGULATIONS

Emission limits for hydrogen chloride (HCl), hydrogen fluoride (HF), sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), particulates (TSP), lead (Pb), asbestos (A), cadmium (Cd) and mercury (Hg) as established by the Denmark National Agency of Environmental Protection, are outlined in Table D-1. The Swedish National Environment Protection Board has issued emission limits for HCl, Hg, TSP and dioxins which are to be implemented in the next few years. These standards are also included in Table D-1. Similarly, new emission standards for municipal waste incinerators (which may treat some types of industrial wastes) and which have a capacity of 20 000 tons/year or greater, have been proposed by the Norwegian Government. These emission standards apply to HCl, SO_2, Hg, Cd, CO and TSP and are outlined in Table D-1. Also included in Table D-1 are emission standards for HCl, hydrogen sulfide (H_2S) and TSP set by the British Government. Emission limits for heavy metals, halogens, sulphur oxides and nitrogen oxides are determined on a case-by-case basis.

Emission standards applicable to hazardous waste incinerators in West Germany were also obtained. Because these standards are presented in a different format from other jurisdictions discussed, they will be outlined separately.

There are two types of standards used to regulate air pollutants in West Germany, ambient and source emission standards. Ambient standards refer to air pollutants affecting humans, animals, plants and materials. Ambient standards expressed as air concentrations are designed to protect against health hazards. Ambient standards expressed as dustfall, i.e., mass deposition related to time, are designed to protect against "considerable disadvantage or substantial impairment". Criteria have been developed to be used in evaluating what constitutes a substantial hazard. Hazards to human health are always considered substantial. In the case of animals, plants and other things, the nature, extent and duration of the disadvantage/impairment are used to determine whether or not effects are substantial. Ambient standards, both expressed as air concentrations and as dustfall, are outlined in Table D-2 with values given for both long-term and short-term exposures.

The second type of standard used in West Germany refers to source emissions and has been set for dusts, inorganic gases and vapours, organics and carcinogens. These standards apply to all facilities applying for a licence. The limits are expressed as concentrations under specified mass flow conditions, where mass flow is the total emission occurring for 1 hour of operation of a facility operating under the most unfavourable conditions. Daily mean concentrations of air pollutants in the waste gas are not to exceed the established concentration. In addition, 97% of all half-hourly means are not to exceed 120% of the established concentration, while all half-hourly means are not to exceed twice the established concentration. Furthermore, pollutants are grouped into different classes and a concentration emission limit defined for each class. The concentration limit established for each class must not be exceeded for any pollutant from that class. In the case of a mixture containing more than one pollutant from a given class, the total concentration of these pollutants must not exceed the established limit.

Source emission standards for dusts present in waste gas are outlined in Table D-3, while standards for inorganic gases and vapours are outlined in Table D-4. Tables D-5a and D-5b outline source emission standards for different classes of organic substances, while Table D-6 outlines standards for carcinogens.

In addition to the general emission standards applicable to all facilities applying for a licence, specific standards exist in West Germany for certain facilities; for example, facilities involved in the partial or entire elimination of solid or liquid residual materials by combustion, have specific emission standards that are outlined in Table D-7. Where the standards differ, the specific standards take precedence over the general standards.

TABLE D-1

EMISSION STANDARDS - DENMARK, SWEDEN, NORWAY, GREAT BRITAIN

Pollutant	Stack Gas Concentrations (mg/m^3) Denmark	Sweden	Norway	Great Britain
Hydrogen Chloride (HCl)	300	100 (m)	100	460
Hydrogen Fluoride (HF)	5			
Hydrogen Sulphide (H_2S)				7
Sulphur Dioxide (SO_2)	500		300	
Lead (Pb)	7 (refers to solid, gas)			
Asbestos	1 (refers to solid)			
Cadmium (Cd)	0.025 refers to solid, gas)		0.1	
Mercury (Hg)	0.025 (refers to solid, gas)	.08*	0.1 (total)	
Particulates (TSP)	100	20 (m)	30	115**
Carbon Monoxide (CO)		-	100	

TABLE D-1 (cont'd)

EMISSION STANDARDS - DENMARK, SWEDEN, NORWAY, GREAT BRITAIN

	Stack Gas Concentrations (mg/m^3)			
Pollutant	Denmark	Sweden	Norway	Great Britain
Dioxins		0.5-2.0 ng/m^3 (existing facilities) 0.1 ng/m^3 (new facilities)		

Notes:

m = monthly average
* It was noted that 0.3 mg/m^3 can be achieved using additional controls
** It was noted that exceptions may be made; however, concentrations not to exceed 460 mg/m^3

Denmark Concentrations are based on dry gas observed at actual CO_2 concentration (typically CO_2 was 7.3% and O_2 was 10.8%). Averaging time period was not noted.
Sweden Concentrations are based on dry gas observed at 10% O_2.
Norway Concentrations are based on dry gas observed at 10% O_2. Averaging time period was not noted.

TABLE D-2

AMBIENT STANDARDS - FEDERAL REPUBLIC OF GERMANY

Pollutant	Concentration (mg/m^3) Long-Term Exposure	Concentration (mg/m^3) Short-Term Exposure	Dustfall ($\mu g/m^3d$) Long-Term Exposure	Dustfall ($\mu g/m^3d$) Short-Term Exposure
Total particulate (TSP)	0.15	0.30	0.35 g/m^3d	0.65 g/m^2d
Lead & inorganic lead compounds (expressed) as Pb	2.0 $\mu g/m^3$	-	0.25 mg/m^2d	-
Cadmium & inorganic cadmium compounds as Cd	0.04 $\mu g/m^3$	-	5	-
Chlorine (Cl_2)	0.10	0.30	-	-
Hydrochloric acid as Cl	0.10	0.20*	-	-
Carbon monoxide (CO)	10	30	-	-
Sulphur Dioxide (SO_2)	0.14	0.40	-	-
Nitrogen Dioxide (NO_2)	0.08	0.20	-	-
Thallium & inorganic thallium compounds as Tl	-	-	10	-
Hydrofluoric acid & inorganic gaseous fluorine compounds as F	-	-	1.0	3.0

Note:

* if hydrochloric acid cannot be measured separately from other chlorides, then the long-term mass concentration is 0.30 mg/m^3

TABLE D-3

SOURCE EMISSION STANDARDS FOR DUSTS PRESENT IN WASTE GAS - FEDERAL REPUBLIC OF GERMANY

Pollutant	Concentration (mg/m^3) under specified mass flow conditions
Total dust	50 for mass flow >0.5 kg/h and 150 for mass flow ≤0.5 kg/h
Class I - cadmium (Cd) & its compounds - mercury (Hg) & its compounds - thallium (Tl) & its compounds	0.20 for mass flow ≥1 g/h
Class II - arsenic (As) & its compounds - cobalt (Co) & its compounds - nickel (Ni) & its compounds - sellenium (Se) & its compounds - tellurium (Te) & its compounds	1 for mass flow ≥5 g/h
Class III - antimony (Sb) & its compounds - lead (Pb) & its compounds - chromium (Cr) & its compounds - cyanides (Cn) easily soluble - fluorides (F) easily soluble - copper (Cu) & its compounds - manganese (Mn) & its compounds - platinum (Pt) & its compounds - palladium (Pd) & its compounds - rhodium (Rh) & its compounds - vanadium (V) & its compounds - Tin (Sn) & its compounds	5 for mass flow ≥25 g/h
Mixture of Class I & II compounds	1
Mixture of Class I & III or Class II & II compounds	5

TABLE D-4
SOURCE EMISSION STANDARDS FOR INORGANICS PRESENT AS GASES OR VAPOURS IN WASTE GAS - FEDERAL REPUBLIC OF GERMANY

Pollutant	Concentration (mg/m^3) under specified mass flow conditions
Class I	
- arsine (AsH_3) - cyanogen chloride (CNCl) - phosgene ($COCL_2$) - hydrogen phosphide (PH_3)	1 for mass flow $\geq$10 g/h
Class II	
- bromine (BR_2) & its vapourous compounds (indicated) as HBr - chlorine (Cl_2) - hydrocyanic acid - fluorine (F_2) & it vapourous compounds as HF - hydrogen sulphide (H_2S)	5 for mass flow $\geq$50 g/h
Class III	
- vapourous inorganic chlorine (Cl_2) compounds (not in Class I) as HCl	30 for mass flow $\geq$0.3 kg/h
Class IV	
- sulphur oxides (SO_2, SO_3) as SO_2 - nitrogen oxides (NO, NO_2) as NO_2	500 for mass flow $\geq$5 kg/h

TABLE D-5a

SOURCE EMISSION STANDARDS FOR DIFFERENT CLASSES OF ORGANICS PRESENT IN WASTE GAS - FEDERAL REPUBLIC OF GERMANY

Pollutant	Concentration (mg/m^3) under specified mass flow conditions
I	20 for mass flow $\geq$0.1 kg/h
II	100 for mass flow $\geq$2 kg/h
III	150 for mass flow $\geq$3 kg/h
Mixture of compounds in several classes	150 for $\geq$3 kg/h (given that the mass conc. allowed for each class is not exceeded)

TABLE D-5b

ORGANIC COMPOUNDS AND THE CORRESPONDING POLLUTANT CLASS

Substances	Organic Substances	Empirical Formula	Class
Acetaldehyde		C_2H_4O	I
Acetone		C_3H_6O	III
Acrolein	cf:2-Propenal		
Acrylic acid		$C_3H_4O_2$	I
Acrylic-acid ethyl ester	cf: Ethyl acrylate		
Acrylic-acid methyl esther	cf: Methyl acrylate		
Alkyl alcohols			III
Alkyl lead compounds			I
Formic acid		CH_2O_2	I
Formic-acid methyl esther	cf: Methyl formate		
Aniline		C_6H_7N	I
Benzyl chloride	cf: Chlorotoluene		
Biphenyl		$C_{12}H_{10}$	I
2-Butanone		C_4H_8O	III
2-Butoxyethanol		$C_6H_{14}O_2$	II
Butyl acetate		$C_6H_{12}O_2$	III
Butylglycol	cf: 2-Butoxyethanol		
Butyric aldehyde		C_4H_8O	II
Chloroacetaldehyde		C_2H_3ClO	I
Chlorobenzene		C_6H_5Cl	II
2-Chloro-1,3-butadiene		C_4H_5Cl	II
Chloroacetic acid		$C_2H_3CLO_2$	I
Chloroethane		C_2H_5Cl	III
Chloromethane		CH_3Cl	I
Chloroform	cf: Trichloromethane		
2-Chloroprene	cf: 2-Chloro-1,3-butadiene		
2-Chloropropane		C_3H_7Cl	II
-Chlorotoluene		C_7H_7Cl	I
Cumene	cf: Isopropylbenzene		
Cyclohexanone		$C_6H_{10}O$	II
Diacetone alcohol	cf: 4-Hdroxy-4-methyl-2-pentanone		
Dibutylether		$C_8H_{18}O$	III
1,2-Dichlorobenzene		$C_6H_4Cl_2$	I
1,4-Dichlorobenzene		$C_6H_4Cl_2$	II

TABLE D-5b (cont'd)

ORGANIC COMPOUNDS AND THE CORRESPONDING POLLUTANT CLASS

Substances	Organic Substances	Empirical Formula	Class
Dichlorodifluoromethane		CCl_2F_2	III
1,1-Dichloroethane		$C_2H_4Cl_2$	II
1,2-Dichloroethane		$C_2H_4Cl_2$	I
1,1-Dichloroethylene		$C_2H_2Cl_2$	I
1,2-Dichloroethylene		$C_2H_2Cl_2$	III
Dichloromethane		CH_2Cl_2	III
Dichlorophenole		$C_6H_4Cl_2O$	I
Diethanolamine	cf: 2,2'-Iminodiethanol		
Diethylamine		$C_4H_{11}N$	I
Diethyl ether		$C_4H_{10}O$	III
Di-(2-ethylhexyl)-phtalate		$C_{24}H_{38}O_4$	II
Diisopropyl ether		$C_6H_{14}O$	III
Diisopropylketone	cf: 2,6-Dimethylheptane -4-on		
Dimethylamine		C_2H_7N	I
Dimethyl ether		C_2H_6O	III
N,N-Dimethyl formanide		C_3H_7NO	II
2,6-Dimethylheptane-4-on		$C_7H_{14}O$	II
Dioctylphtalate	cf: Di-(2-ethylehexyl)-phtalate		
1,4-Dioxan		$C_4H_8O_2$	I
Diphenyl	cf: Biphenyl		
Acetic ester	cf: Ethyl acetate		
Acetic acid		$C_2H_4O_2$	II
Acetic-acid butyl ester	cf: Butyl acetate		
Acetic-acid methyl ester	cf: Ethyl acetate		
Acetic-acid methyl ester	cf: Methyl acetate		
Acetic-acid vinyl ester	cf: Vinyl acetate		
Ethanol	cf: Alkyl alcohols		
Ether	cf: Diethyl ether		
2-Ethoxyethanol		$C_4H_{10}O_2$	II
Ethyl acetate		$C_4H_8O_2$	III
Ethylacrylate		$C_5H_8O_2$	I
Ethylamine		C_2H_7N	I
Ethylbenzene		C_8H_{10}	II
Ethyl chloride	cf: Chloroethane Chlorethan		

TABLE D-5b (cont'd)

ORGANIC COMPOUNDS AND THE CORRESPONDING POLLUTANT CLASS

Substances	Organic Substances	Empirical Formula	Class
Ethylene glycol		$C_2H_6O_2$	III
Ethylene glycol ethyl ether	cf: 2-Ethoxyethanol		
Ethylene glycol methyl ether	cf: 2-Methoxyethanol		
Ethylglycol	cf: 2-Ethoxyethanol		
Ethylmethylketone	cf: 2-Butanone		
Formaldehyde		CH_2O	I
2-Furylaldehyde		$C_5H_4O_2$	I
Furfural, Furfurol	cf: 2-Furylaldehyde		
Fufuryl alcohol		$C_5H_6O_6$	II
Glykol	cf: Ethylene glycol		
Respirable wood particles			I
4-Hydroxy-4-methyl-2-pentanone		$C_6H_{12}O_2$	III
2,2'-Iminodiethanol		$C_4H_{11}NO_2$	II
Isobutylmethylketone	cf: 4-Methyl-2-pentanone		
Isopropenylbenzene		C_9H_{10}	II
Isopropylbenzene		C_9H_{12}	II
Carbon disulfide		CS_2	
Cresols		C_7H_8O	I
Maleic anhydride		$C_4H_2O_3$	I
Mercaptans	cf: Thioalcohols		
Methyl metacrylate	cf: Methylmetacrylate		
Methanol	cf: Alkyl alcohols		
2-Methoxyethanol		$C_3H_8O_2$	II
Methyl acetate		$C_3H_6O_2$	II
Methyl acrylate		$C_4H_6O_2$	I
Methylamine		CH_5N	I
Methyl benzoate		$C_8H_8O_2$	III
Methyl chloride	cf: Chloromethane		
Methylchloroform	cf: 1,1,1-Trichlorethane		
Methylcyclohexanons		$C_7H_{12}O$	II
Methylen dichloride	cf: Dichloromethane		
Methylethylketone	cf: 2-Butanone		
Methyl formate		$C_2H_4O_2$	II
Methyl glycol	cf: 2-Methoxyethanol		
Methyl isobutyl ketone	cf: 4-Methyl-2-pentanone		

TABLE D-5b (cont'd)

ORGANIC COMPOUNDS AND THE CORRESPONDING POLLUTANT CLASS

Substances	Organic Substances	Empirical Formula	Class
Methyl methacrylate		$C_5H_8O_2$	II
4-Methyl-2-pentanone		$C_6H_{12}O$	III
4-Methyl-m-phenylenedi-isocyanate		$C_9H_6N_2O_2$	I
N-Methylpyrrolidone		C_5H_9NO	III
Naphthaline		$C_{10}H_8$	II
Nitrobenzene		$C_6H_5NO_2$	I
Nitrocresols		$C_7H_7NO_3$	I
Nitrophenols		$C_6H_5NO_3$	I
Nitrotoluene		$C_7H_7NO_2$	I
Olefin hydrocarbons (except 1,3-Butadiene)			III
Paraffin hydrocarbons (except Methane)			III
Perchloroethylene	cf: Tetrachloroethylene		
Phenol		C_6H_6O	I
Pinenes		$C_{10}H_6$	III
2-Propenal		C_3H_4O	I
Propionaldehyde		C_3H_6O	II
Propionic acid		$C_3H_6O_2$	II
Pyridine		C_5H_5N	I
Sulfide of carbon	cf: Carbon disulphide		
Styrene		C_8H_8	II
1,1,2,2-Tetrachlorethane		$C_2H_2Cl_4$	I
Tetrachloroethylene		C_2Cl_4	II
Carbon tetrachloride	cf: Tetrachloromethane		
Tetrachloromethane		CCl_4	I
Tetrahydrofuran		C_4H_8O	II
Thioalcohols			I
Thioether			I
o-Toluidine		C_7H_9N	I
Toluene		C_7H_8	II
Toluylene-2,4-diisocyanate	cf: 4-Methyl-m-phenyl-lendiisocyanate		
1,1,1-Trichloroethane		$C_2H_3Cl_3$	II
1,1,2-Trichloroethane		$C_2H_3Cl_3$	I

TABLE D-5b (cont'd)

ORGANIC COMPOUNDS AND THE CORRESPONDING POLLUTANT CLASS

Organic Substances		
Substances	Empirical Formula	Class
Trichlorethylene	C_2HCl_3	II
Trichlormethane	$CHCl_3$	I
Trichlorphenols	$C_6H_3OCl_3$	I
Triethylamine	$C_6H_{15}N$	I
Trichlorofluoromethane	CCl_3F	III
Trimethylbenzenes	C_9H_{12}	II
Vinyl acetate	$C_4H_6O_2$	II
Xylenols (except 2,4-Xylenol)	$C_8H_{10}O$	I
2,4-Xylenol	$C_8H_{10}O$	II
Xylenes	C_8H_{10}	II

TABLE D-6

SOURCE EMISSION STANDARDS FOR CARCINOGENS PRESENT IN WASTE GAS - FEDERAL REPUBLIC OF GERMANY

Pollutant	Concentration (mg/m^3) under specified mass flow conditions
Class I	
- asbestos as fine dust	0.1 for mass flow $\geq$0.5 g/h
- benzo(a)pyrene	
- beryllium & its respirable compounds indicated as Be	
- dibenz(a,h)anthracen	
- 2-naphtalamine	
Class II	
- arsenic trioxide & arsenic pentoxide, arsenious acid & its salts, arsenic acids & its salts (respirable) as As	
- chromium (VI) compounds (respirable): calcium chromate chromium (III) chromate, strontium chlromate & zinc chromate as Cr	
- respirable dusts/aerosols of cobalt metal and cobalt salts of low solubility as Co	
- 3,3'-dichlorobenzidine	
- dimethyl sulphate	
Class II	
- ethyleneimine	1 for mass flow $\geq$5 g/h
- respirable dusts/aerosols of nickel metal, nickel sulphide & pyritiferous ores, nickel oxide & nickel carbonate, nickel tetracarbonyl as Ni	

TABLE D-6 (cont'd)

SOURCE EMISSION STANDARDS FOR CARCINOGENS PRESENT IN WASTE GAS - FEDERAL REPUBLIC OF GERMANY

Pollutant	Concentration (mg/m^3) under specified mass flow conditions
Class III	
- acrylonitrile	5 for mass flow $\geq$25 g/h
- benzene	
- 1,3-butadiene	
- 1-chloro-2-3,-epoxypropane (epichlorohydrin)	
- 1,2-dibromomethane	
- 1,2-epoxypropane	
- ethylene oxide	
- hydrazine	
- vinyl chloride	
Mixture - Class I & II compounds	1
Mixture - Class I & III or Class II & III compounds	5

TABLE D-7

SOURCE EMISSION STANDARDS APPLICABLE TO FACILITIES FOR THE PARTIAL OR ENTIRE ELIMINATION OF SOLIDS OR LIQUID BY COMBUSTION - FEDERAL REPUBLIC OF GERMANY

Pollutant	Concentration (mg/m^3)
- carbon monoxide (CO)	0.10
- organics (as total carbon)	20
- sulphur oxides (SO_2, SO_3) as SO_2	0.10*1
- gaseous inorganic chlorine compounds as HCl	50*2
- gaseous inorganic fluorine compounds as HF	2*3
*4	

Notes:

*1 if concentration of 0.10 mg/m^3 is not reasonably attainable, then an emission factor of 3% sulphur is used

*2 if concentration of 50 mg/m^3 is not reasonably attainable, then an emission factor of 0.25% chlorine is used

*3 if concentration of 2 mg/m^3 is not reasonably attainable, then an emission factor of 0.25% fluorine is used

*4 the emission standards for dusts given in Table D-3 for Classes I, II, III and different class mixtures, apply but with no mass flow specified

APPENDIX E

BASELINE MONITORING PROGRAM PROTOCOL

E-1 INTRODUCTION

The purpose of the Phase 4B monitoring program was to document "background" air quality and meteorological conditions at the preferred site. In conjunction with other work, this information forms the detailed environmental impact assessment of the proposed OWMC facility and was also used for comparison with post-operational monitoring data.

An important component of any environmental impact assessment is the procurement and consolidation of information on prevailing conditions at the study site. The primary reasons for procuring comprehensive background data on atmospheric dispersion and air quality parameters through a pre-operational monitoring program are:

- to define existing air quality for future reference,
- to document the dispersive capacity of the local atmosphere in sufficient detail to permit the required predictive modelling to be undertaken,
- to provide data that enables a detailed assessment of the potential environmental impact that may be associated with the proposed facility,
- to provide information that can be used in making future decisions on emission control measures required to ensure that no adverse impact occurs,
- to demonstrate to the public a firm commitment to document and minimize any potential impact that might occur.

The atmospheric studies undertaken in previous phases of the OWMC program provided the general framework within which to define the scope and content of the Phase 4B site-specific studies. The dispersive capacity of the atmosphere in Southern Ontario, and more specifically the Golden Horseshoe, has been described and specific features which can result in poor dispersion have been identified. Candidate areas, candidate sites and the preferred site were subsequently selected in Phases 3A, 3B and 4A. Air dispersion and air quality considerations played a key role in the site selection process.

While preliminary emission estimates suggest that relatively low concentrations of "criteria" pollutants can be expected to occur in the vicinity of the OWMC facility, the potential for the release of trace amounts of a wide range of potentially hazardous substances must also be recognized. It is this feature of a waste disposal facility that necessitates a comprehensive monitoring program both before and after installation of the facility.

To the extent possible, the scope and content of the pre-operational monitoring activity were designed with the requirements of such subsequent operational monitoring needs in mind.

E-2 SCOPE OF WORK

E-2.1 General Scope

One air quality and meteorological station was established on the preferred site in order to monitor background air quality and existing meteorological conditions over the required period of one year. The data collected was summarized and interpreted in periodic reports to the Ontario Waste Management Corporation.

The following air quality and meteorological parameters were monitored:

- sulphur dioxide (SO_2) (continuously)
- nitrogen oxides (NO and NO_2) (continuously)
- ozone (O_3) (continuously)
- total reduced sulphur (TRS) (continuously)
- total hydrocarbons (THC) (continuously)
- total suspended particulate (TSP) and fine particulate (FP) matter (every third day for 24 hours)
- wet/dry deposition primarily of trace metal constituents (weekly sample collection composited for monthly analysis)
- trace inorganic and organic constituents (fluorides, chlorides, mercury, PCB's, chlorophenols, chlorobenzenes, herbicides, pesticides, dioxins, and PAH's) (every 18th day for 24 hours)

- trace metals associated with particulate matter (Al, As, B, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, K, Mg, Mn, Mo, Na, Ni, P, Pb, Sb, Se, Si, Sn, Te, V, Zn) (every 18th day for 24 hours)
- wind speed and wind direction (at 30 m and 10 m heights) (continuously)
- air temperature (at 30 and 10 m) (continuously)
- solar radiation (at 10 m) (continuously)
- rainfall/snowfall rate (event basis)

In addition, periodic special studies were conducted each season to include:

- upper air measurements of mixing heights, stability and winds using a minisonde (1 release every 3 hours during a two week period each season)
- background scan of atmospheric trace organic constituents, using a TAGA mobile monitoring facility (one day for three seasons). The mass spectrometric data obtained will serve as a general reference for comparison with any post operational monitoring (either general or for specific target compounds) that may be required.

E-2.2 Monitoring Concept

The monitoring station is located at OWMC's preferred site in the Township of West Lincoln, Ontario. A detailed site map, indicating the actual location of the on-site station, is provided in Figure E-1 at a scale of 1:10,000. Figure E-2 illustrates the site layout of monitoring instruments. Gas analyzers were located inside the trailer and sampled outside air through a glass manifold inlet. Particulate measurements were made on the roof of the trailer, as were deposition and precipitation measurements. Meteorological equipment was mounted on the 30 m tower at two levels (30 and 10 m). As indicated in Figure E-2, continuous monitors and/or sensors were connected to a remote data

collection unit, which in turn transmitted the data via modem and dedicated communication lines to the computers at ORF in Mississauga. Particulate, deposition and trace inorganic/organic cumulative sampling devices required manual removal of collection media and subsequent analysis in laboratories at ORF. Minisonde upper air studies were undertaken each season from locations within the site or on the road near the site. A TAGA mobile monitoring unit was used to conduct on-site analysis of numerous trace organic compounds for three seasons.

E-3 TECHNICAL SPECIFICATIONS OF MONITORING INSTRUMENTATION

E-3.1 Sulphur Dioxide

E-3.1.1 Scope and Application

Sulphur dioxide (SO_2) was measured on a continuous, real time basis using a pulsed fluorescent ambient SO_2 monitor (Thermo Electron Model 43), which is a self-contained, analytical instrument. The method is intended for application where concentrations of sulphur dioxide are in the range of approximately 0.01 to 5 ppm. It is regarded as an equivalent to the standard West Gaeke wet chemical reference method (CSA Standard Z223.33-M1980) and is used in many North American monitoring networks.

E-3.1.2 Sampling and Analysis Method

A portion of air was drawn through the glass intake manifold and filtered through a teflon filter to remove particulate matter and was continuously supplied via teflon tubing to the analyzer. The pulsed fluorescence method is based on the principle that sulphur dioxide fluoresces when it is exposed to short wavelength radiation (i.e., UV light source). The characteristic fluorescent radiation which is emitted upon decay of excited SO_2 molecules is separated from the incident UV light by narrow band pass filters and measured by sensitive photomultiplier tubes.

Electronic processing converts the light energy to a voltage proportional to the concentration of SO_2 in the sample being analyzed. Detailed descriptions of the instrument components and their operation are available in the reference material provided.

E-3.1.3 Calibration Method

The instrument was calibrated daily using a single point SO_2 permeation calibrator (Thermal Electron Model 145) containing a certified permeation tube held at $35 \pm 0.1^{o}C$ such that a known permeation rate was diluted with a known volume of clean air. The SO_2 concentration generated by the calibrator is representative of typical atmospheric concentrations and, in conjunction with the zero mode of operation, provides two calibration points to check instrument performance. Multipoint calibration procedures were conducted on a monthly basis.

E-3.1.4 Potential Interferences

The measurement technique is specific for sulphur dioxide and the method is relatively interference-free. Interference equivalents by other gases are reportedly small, being less than 0.01 ppm for interfering gases such as ozone, nitric oxide and hydrocarbons at concentrations normally encountered in ambient air. Interference by water vapour must be eliminated, for example by the use of a permeation drying device inherent in the sample gas stream of the analyzer.

E-3.1.5 Typical Performance Characteristics

The performance characteristics summarized below generally apply to pulsed fluorescence instruments.

Range:	0 to 5 ppm SO_2
Minimum Detectable Sensitivity:	0.01 ppm SO_2 at 25°C and 1 atmosphere
Noise:	0.007 ppm SO_2
Lag Time:	less than 10 s
Rise Time to 90%:	4 min
Fall Time to 90%:	4 min
Precision:	± 1% full scale
Accuracy:	± 1% full scale
Zero Drift:	± 1% full scale per day
Span Drift:	± 1% full scale per day
Sample Flowrate:	Approximately 1.5 L/min
Relative Humidity Range:	0 to 100%
Operating Temperature:	A temperature controlled environment (i.e., 20 to 30°C) is required for the analyzer

E-3.1.6 References

Canadian Standards Association, CSA Standard Z223.22-M1980, Method for the Measurement of Sulphur Dioxide in Air, September 1980.

Thermo Electron Corporation, Instruction Manual, Model 43, Pulsed Fluorescent Ambient SO_2 Analyzer Equipped with an Aromatic Hydrocarbon Cutter TE5405-112-77, Revision C.

Thermo Electron Corporation, Instruction Manual, Model 143, Permeation Tube Calibrator Amended for Model 145, January 1978.

E-3.2 Nitrogen Oxides

E-3.2.1 Scope and Application

Nitric oxide (NO) and nitrogen dioxide (NO_2) were sequentially measured using the chemiluminescence method (Thermo Electron Series 14 analyzer), in accordance with CSA Standard Method #Z223.24-M1983. This method is widely used for the measurement of NO and NO_2 within the range of 0.007 to 10 ppm.

E-3.2.2 Sampling and Analysis Method

As for other continuous monitoring instruments, outside air was filtered through teflon filters to remove particulate matter and then transmitted through teflon tubing. The chemiluminescence method is based on the principle that NO and O_3 react to produce electronically excited NO_2 that emits radiation between 600 and 2500 nm. The reaction is:

$$NO + O_3 \blacksquare NO_2^* + O_2$$

$$NO_2^* \blacksquare NO_2 + h\nu$$

When NO and excess O_3 (generated by the instrument) are mixed in a reaction chamber, the emitted radiation is proportional to the concentration of NO and is detected by a photomultiplier tube. The resulting current is amplified, displayed, and calibrated in terms of NO concentration.

In the NO cycle, the sample air stream enters the reaction chamber directly so that the resulting signal is proportional to the NO concentration. In a second cycle, the sample air first passes through a catalytic converter where NO_2 is transformed to NO before entering the reaction chamber. The resulting signal is then proportional to the sum of the converted NO (equivalent to the original NO_2), and the unaltered NO concentration (as measured in the previous cycle) for the total nitrogen oxides (NO_x). The NO_2 concentration is thus obtained from the difference between the outputs of the two cycles. The two measurements (NO, NO_x) are available as continuous analogue outputs at two separate signal outputs.

E-3.2.3 Calibration Method

Instrument calibration was done by the gas-phase titration method using an external calibration O_3 generator in conjunction with a primary NO standard (certified cylinder mixture of NO in nitrogen) at representative ambient concentrations. The concentration of NO_2 produced in this manner is regarded as being more reliable than NO_2 generated by permeation tubes. Detailed multipoint calibration of the analyzer was done once per month with daily system checks performed using an automated single point calibration (Thermo Electron Model 102N) which used diluted certified NO and an O_3 generator to react with NO to produce NO_2.

E-3.2.4 Interference

The reaction of nitric oxide with ozone in the analyzer is not subject to interference from common air pollutants. A cut-off filter to remove light of wavelength less than 600 nm is inserted in front of the photomultiplier tube to eliminate possible chemiluminescent reactions with ozone from components such as ethylene and hydrogen sulphide.

E-3.2.5 Performance Characteristics

Reported performance characteristics that generally apply to NO_x chemiluminescent analyzers are:

Range:	0 to 10 ppm
Minimum Detectable Concentration:	0.003 ppm 0.007 ppm for NO_2
Noise:	0.002 ppm for NO and 0.004 ppm for NO_2
Lag Time:	1 s
Rise Time to 90%:	Less than 20 s
Fall Time to 90%:	Less than 20 s
Precision:	± 1% full scale
Accuracy:	± 1% full scale
Zero Drift:	± 0.4% full scale per day ± 0.5% full scale per 7 days
Span Drift:	± 2% per day ± 3% per 7 days
Linearity:	± 1% full scale
Unattended Operation:	30 days
Sample Flowrate:	approximately 1.5 L/min
Operating Humidity Range:	0 to 95%
Operating Temperature Range:	A temperature-controlled environment (10 to 40°C) is required for the analyzer

E-3.2.6 References

Canadian Standards Association, CSA Standard Z223.24-M1983 Method for the Measurement of Nitric Oxide and Nitrogen Dioxide in Air, March 1983.

Thermo Electron Corporation, Instruction Manual, Model 14, Chemiluminescent NO-NO_x Gas Analyzer TE5250-49-74, November 1973.

Thermo Electron Corporation, Instruction Manual, Model 102N, Precision Calibrator (NO_x Version).

E-3.3 Ozone

E-3.3.1 Scope and Application

Ozone (O_3) was continuously measured with the same Thermo Electron Series 14 chemiluminescent analyzer being used to measure NO and NO_2.

E-3.3.2 Method of Analysis

The retrofitted $NO/NO_2/O_3$ analyzer has three distinct cycles (two of which have been described in Section 4.2.2). The first two cycles measure NO and NO_2, while the third cycle measures O_3. After flushing the reaction chamber with air, the ambient air flow is mixed with an excess of NO. This NO reacts with any O_3 in the air sample, and the resultant signal is proportional to the concentration of O_3 in the air sample.

E-3.3.3 Calibration Method

Single point zero and span checks of the instrument were done daily using zero air, an ozone generator, and a certified NO/N_2 gas mixture, as described in Section E-3.2.3. Detailed monthly calibration of the specific response of the instrument to ozone was done using the gas-phase titration method, also described in Section E-3.2.3. In this case, known amounts of NO were mixed with a slight excess of ozone using a stable external ozone source and reacted before entering the analyzer. By varying the NO concentration, known amounts of residual ozone were generated for a multipoint instrument calibration.

E-3.3.4 Interferences

See Section E-3.2.4. The use of the same instrument to measure both ozone and nitrogen oxide levels also gives rise to the possibility of "cross-contamination" of these two constituents. It was essential, therefore, that close attention be given to the operational performance of valves, solenoids, pumps and other gas flow components that might result in cross-contamination between cycles.

E-3.3.5 Performance Characteristics

Performance characteristics are as defined in the NO/NO_2 section.

E-3.3.6 References

Canadian Standards Association, CSA Standard Z223.23-M1981, Method for the Measurement of Ozone in Air, June 1981.

Thermo Electron Corporation, Instruction Manual, Model 14, Chemiluminescent $NO-NO_x$ Gas Analyzer Amended for Ozone Monitoring TE-5250-49-74, November 1973.

Thermo Electron Corporation, Instruction Manual, Model 102N, Precision Calibrator (NO_x Version).

E-3.4 Total Reduced Sulphur

E-3.4.1 Scope and Application

Total reduced sulphur compounds (TRS), which consist primarily of hydrogen sulphide (H_2S), were measured continuously on a real time basis. A catalytic converter (Thermo Electron Model 340) was used to convert the TRS to SO_2 which was then measured by a pulsed fluorescent ambient SO_2 monitor (Thermo Electron Model 45). As of June 1987, a thermal oxidizer was used (Sampling Technology Model TX010-TC) to convert the reduced sulphur compounds. The method is applicable to a range of 0.002 to 5 ppm.

E-3.4.2 Sampling and Analysis Method

The converter section of the Model 45 catalytically converts reduced sulphur compounds to SO_2 so that the output of the analyzer is equal to the concentration of such compounds entering the converter. Any SO_2 present in the original sample is removed prior to its entrance into the converter, by means of a scrubber cartridge consisting of barium acetate and sulfamic acid solution supported on molecular sieve material. The thermal oxidizer oxidizes all forms of reduced sulphur in the presence of an excess of oxygen to SO_2. The SO_2 analyzer used as part of this analysis is based upon the principle of pulsed fluorescence, as described in Section E-3.1.

E-3.4.3 Calibration Method

The instrument was calibrated daily using a single point permeation calibrator (Thermo Electron Model 145) containing a certified H_2S

permeation tube held at 35 ± 0.1°C such that a known permeation rate was diluted with a known volume of clean air. The H_2S concentration generated by the calibrator is representative of typical atmospheric concentrations and, in combination with the zero mode of operation, two calibration points are provided to check instrument performance. More detailed multipoint calibration procedures were conducted monthly.

E-3.4.4 Typical Performance Characteristics

The performance characteristics of the pulsed fluorescence analyzer can be found in Section 3.1.5, as pertaining to SO_2. The H_2S converter specifications are presented below:

Range:	0 to 5 ppm of H_2S @ 25°C and 1 atmosphere
Noise:	.001 ppm
Minimum Detectable Concentration:	.002 ppm
Lag Time:	15 sec
Rise Time (0-95%):	2 min
Fall Time (0-95%):	2 min
Precision:	± 0.5%
Zero Drift:	± .003 ppm 24 hrs ± .005 ppm 7 days
Span Drift:	± 1% 24 hr ± 2% 7 days
Operating Temperature:	5 to 45°C

E-3.4.5 References

Sampling Technology, Inc., Technical Manual, Operation and Service, Thermal Oxidizer, Model TX010-TC, 1987.

Thermo Electron Corporation, Instruction Manual, Model 43, Pulsed Fluorescent SO_2 Analyzer Equipped with an Aromatic Hydrocarbon Cutter Amended for Model 45-1 Including use with Model 340 H_2S Converter TE5402-112-77, Revised 12-1-82.

Thermo Electron Corporation, Instruction Manual, Model 340, H_2S Converter Amended for Use with SO_2 Scrubber.

Thermo Electron Corporation, Instruction Manual, Model 143, Permeation Tube Calibrator Amended for Model 145 H_2S Option, January 1978.

E-3.5 Hydrocarbons

E-3.5.1 Scope and Application

Total hydrocarbon concentrations were measured continuously using a Ratfish RS5 analyser.

E-3.5.2 Sampling and Analysis

Prefiltered air travelled through teflon lines from the glass sampling manifold to the instrument. The RS5 uses flame ionization as the principal of detection. The hydrogen/air flame intensity increases when carbon atoms are oxidized in the flame. This increase in the flame intensity is monitored by the analyzer and converted to an electronic signal. The detector is contained in an oven at 160°C. Results were expressed in ppm methane equivalents.

E-3.5.3 Calibration Method

The zeroing and spanning of the instrument was accomplished using an external set of solenoid valves which are controlled by an electronic timer. Once daily zero air and span gases were supplied to the analyzer. The span gas consisted of approximately 5 ppm methane gas in Ultra Zero Air.

E-3.5.4 Typical Performance Characteristics

The values presented below are as specified by the manufacturer:

Range:	0-10 ppm, 0-100 ppm, 0-1000 ppm
Output:	0-10 volt
Lower Detection Limit:	1 ppm

E-3.5.5 References

Ratfish Instruments Promotional Brochure.

E-3.6 Other Particulate/Gaseous Pollutants - Cumulative Measurements of Inorganic Compounds, Chlorinated Organic Compound Classes, and PAH's

E-3.6.1 Inorganic Compounds

E-3.6.1.1 Fluorides

E-3.6.1.1.1 Scope and Application

Particulate and gaseous fluoride containing compounds were collected by a low-volume dual filterpack approach using a citric acid filter to collect the particulate fraction and a sodium hydroxide impregnated filter to trap the gaseous fraction. Quantification was by ion chromatography. Fluoride concentrations in ambient air are typically reported to be within the range of 0.05 to 4 $\mu g/m^3$ and a CSA standard of this method is currently being prepared.

E-3.6.1.1.2 Sampling Method

Both filters were retained in a dual filterpack holder that was sheltered from precipitation but freely exposed to ambient air. A metered volume of air was sampled cumulatively for a 24-hour period at a flowrate of 17 to 33 L/min by means of a timer-controlled sampling device (i.e., Metrix Model SAS-8 sequential sampler). Fluoride-containing particulate matter was collected on the acid-treated pre-filter and subsequently analyzed. Gaseous fluoride compounds collected on the pre-cleaned and alkaki-treated second filter were converted to sodium fluoride.

E-3.6.1.1.3 Analysis Method

Each filter was extracted with deionized water and, after neutralizing alkalinity of the impregnated filter extract with sulphuric acids, water soluble fluoride compounds were determined using ion chromatography.

E-3.6.1.1.4 Calibration

The sampling flowrate was calibrated by a primary standard after leak checks. The analytical technique was calibrated with a series of working standard fluoride solutions over the application range of interest.

E-3.6.1.1.5 Interference

Strong acid in ambient air may react with particulate fluoride to release gaseous hydrogen fluoride that is retained in the second filter. For this reason, total fluorides are reported rather than the content of separate fractions. Similarly, strong acid gases may react with alkali on the second filter which could reduce collection efficiency for gaseous fluorides.

E-3.6.1.1.6 References

Canadian Standards Association, Method for the Measurement of Fluoride-Containing Compounds in Air, CSA Proposed Standard Provisional Number P.9.8.18, Second Draft, March 1984.

Metrex Instruments Limited, SAS-B-1, Air Sampler Manual, January 1985.

E-3.6.1.2 Chlorides

E-3.6.1.2.1 Scope and Application

Chloride monitoring was done in an identical fashion to fluoride measurements using the same dual filterpack collection system. The chloride content in both filters were analyzed by ion chromatography from the same deionized water extract used to determine total water soluble chloride.

E-3.6.1.2.2 References

U.S. Department of Health and Human Services, NIOSH Manual of Analytical Methods, Third Edition, Volume 1, Methods 7903, Peter M. Eller, Editor, February 1984.

E-3.6.1.3 Cyanide

E-3.6.1.3.1 Scope and Application

Efforts were made to measure cyanide in air by sampling with the same dual filterpack system (i.e., collection of HCN vapour with the sodium hydroxide impregnated filter) and analyzing by the ASTM colourimetric technique. The deionized water extract of filters was split for complexing with chloramine-T. After colour formation with the addition of a pyridine-barbituric acid reagent, adsorbance was measured at 578 nm using a spectrophotometer. Calibration was done with a working KCN standard solution. Although water samples and industrial air samples (impinger techniques) are routinely analyzed by this approach, ambient air data are limited.

The colourimetric determination is susceptible to several potential interferences (e.g., other substances that create colour or turbidity). In addition, some cyanide compounds are unstable and subject to photodecomposition and/or oxidation. In this regard, samples collected were protected from light and analyzed as soon after collection as possible. Only a limited number of ambient air measurements (6) were conducted.

E-3.6.1.3.2 Reference

"Standard Test Methods for Cyanides in Water" ASTM D2036-82, 1985.

E-3.6.1.4 Total Mercury

E-3.6.1.4.1 Scope and Application

Total mercury was collected in a cumulative low-volume sampling system comprising of a pre-filter, a pyrolyzer to convert gaseous mercury compounds to elemental mercury vapour and silver amalgamation tubes to adsorb elemental mercury vapour. Quantification was by cold vapour atomic adsorption (UV spectrophotometry). The method is capable of measuring total airborne mercury in the range of 0.003 to 5 $\mu g/m^3$ and a typical average urban/rural concentration, determined by this and other techniques, is reported to be 0.01 $\mu g/m^3$. A CSA standard of this method is currently being prepared.

E-3.6.1.4.2 Sampling Method

Particulate mercury in air was collected by a heat-cleaned glass fibre filter and mercury vapours were collected, after high temperature

pyrolysis (560-700°C) during sampling, by amalgamation of resulting elemental mercury vapour on cooled metallic silver collectors (2 tubes in series). Cumulative sampling was conducted for a 24-hour period at a flowrate of 1 L/min in conjunction with a timer-controlled sampling device (Nutech Model 221 AC/DC). Both filters and silver adsorbers were thermally cleaned prior to sampling to remove residual mercury. The filter was positioned beneath a rain shelter and connected to the pyrolyzer/adsorber within the facility via a short length of teflon tubing.

E-3.6.1.4.3 Analysis Method

During laboratory analysis, mercury contained in silver adsorbers was released by thermal desorption at 530°C and transferred to an acid/permanganate solution. Filters were digested directly in acid/permanganate. The mercury was then released from solution after permanganate reduction and purging and measured at a wavelength of 254 nm by long path cell ultraviolet absorption spectrophotometry (Pharmacia UV Mercury Monitor). Both particulate and gaseous results were combined to obtain the total integrated mercury concentration.

E-3.6.1.4.4 Calibration

After leak checks, the sampling system flowrate was calibrated at the inlet by a primary standard. The spectrophotometer is calibrated with known quantities of mercury in solution (2 to 50 ng).

E-3.6.1.4.5 Interference

There are no known interferences with the method. Loss of mercury that is associated with particulate matter may occur due to volatilization during sampling. This mercury, which is volatilized from particulate matter, may then be trapped on silver adsorbers behind the filter. The silver adsorbers are used to collect mercury vapours. Surface characteristics of the silver adsorption tubes can be altered through reaction with vapours of chlorine, hydrochloric acid and reduced sulphur compounds. Hence, confirmation of satisfactory collection efficiency may be required if sampling in areas where high levels of these gaseous compounds occur.

E-3.6.1.4.6 References

Canadian Standards Association, Method for the Measurement of Total Mercury in Air, CSA Proposed Standard (Provisional), Sixth Draft, 1985.

Barton, S.C., N.D. Johnson and J. Christison, "A Study of Atmospheric Mercury Deposition in Ontario", ORF Report P-2699/G-05 to Ontario Ministry of the Environment, November 1981.

Corte, G., L. Dubois and J.L. Monkman, A Reference Method for Mercury in Air, The Science of the Total Environment 2:89, 1973.

Nutech Corporation Operating Manual, Model 221-1A AC/DC Sampler for Remote Sample Collection Using Wet Chemical Collectors and Gas Chromatography Cartridges.

E-3.6.2 Organochlorine Compounds

It should be noted that methods for the detection of organochlorine compounds in ambient air are not well established and some methods development was necessary.

E-3.6.2.1 Polychlorinated Biphenyls (PCB's)

E-3.6.2.1.1 Scope and Application

PCB's were collected using a low-volume Florisil adsorbent method with subsequent analysis by gas chromatography-electron capture detection. The method has been used in Ontario to measure over a concentration range of 0.1 ng/m^3 to 0.015 $\mu g/m^3$ total PCB's. Typical rural concentrations in the range of 0.2-2.0 ng/m^3 can be expected.

E-3.6.2.1.2 Cleanup and Preparation

All glassware and associated materials underwent extensive reagent grade acetone/pentane solvent rinses and were subsequently proved suitable for usage in the trace PCB analysis by gas-chromatography. No more than 1.0 ng of PCB's was the acceptable level for clean glassware.

Both the Florisil used for sampling (30/60 Mesh) and the Florisil used for cleanup (100/200 Mesh) were cleaned by thermal desorption. The 100/200 Mesh Florisil was deactivated by three percent water deactivation. The level of acceptance for cleanup Florisil was total PCB content of less than 1 ng per elution column. Packed sample

cartridges were cleaned by reagent grade 10% methylene chloride/pentane and pentane elution and were proved and reactivated before use in the field. The acceptable value for clean sampling cartridges was also 1.0 ng. Periodically a cartridge was used as a laboratory blank and analyzed for contamination.

E-3.6.2.1.3 Sampling

An air intake system (Nutech Model 221 AC/DC) controlled a flow of 7-10 liters of air per minute through the sampling cartridges which were stationed beneath a rain shelter for a sampling period of 24 hours. A sampling cartridge, chosen at random from the lot, was used as a field blank and checked for contamination.

E-3.6.2.1.4 Analysis and Calibration

The sampling cartridges were eluted with reagent grade pentane and cleaned with 3 percent deactivated Florisil. The extracts were evaporated to small volumes and aliquots were injected into a gas-chromatograph (Varian Model 3500) with dual capillary electron capture detection. A standard was synthesized from a mixture of commercial Aroclors 1016, 1221 and 1254. A 1.5 µl aliquot was injected per column. Quantification was accomplished by comparing retention times of sample chromatograph peaks with those of the standard.

E-3.6.2.1.5 Interference

The potential exists for positive interference by other organic materials having similar retention times. However, interferences were minimized by utilizing a dual capillary column approach.

E-3.6.2.1.6 References

Barton, S.C., G.H.S. Thomas and N.D. Johnson, An Assessment of Atmospheric PCB Levels in Mississauga, ORF Report No. P-2818/G (Revised)-01, November 1978.

MOE (Ontario Ministry of the Environment), The 1979 Ontario-Wide Survey for Polychlorinated Biphenyls in Ambient Air, Summary Report ARB-TDA 42-80, May 1980.

MOE (Ontario Ministry of the Environment), Method for Sampling and Analysis of Polychlorinated Biphenyls in Ambient Air, Report AMP-137, January 1984.

E-3.6.2.2 Chlorobenzene (CB's)

Florisil cartridges used for PCB determinations were also analyzed for airborne chlorobenzenes (all the CB's from tri to hexa) from hexane or pentane extracts by the same GC-EC techniques. Standards containing mixtures of all chlorobenzene compounds (i.e., 10 compounds) were used for quantification in order to permit reporting of individual and total chlorobenzene concentrations.

E-3.6.2.3 Organochlorine Pesticides (OC's)

Florisil cartridges used for PCB's and CB's were also analyzed for the following typical organochlorine pesticides, namely p,p'-DDE Dieldrin, Heptachlor epoxide (HE), and oxychlordane. Following the removal of PCB's and CB's, the sample was further eluted with 30% dichloromethane in hexane for the OC's. The extract was concentrated and analyzed by GC/EC.

E-3.6.2.4 Chlorophenols (CP's)

Chlorophenols were sampled on another Florisil cartridge. An extraction of the cartridge with acidified methanol was done to remove chlorophenols. This extract was concentrated to dryness followed by methylation with diazomethane. The methylated chlorophenols were further cleaned up using a Florisil column for analysis with GC-EC using the same analytical system as for PCB's. Methods development was carried out with the following typical chlorophenols: 2,4,6-tri CP, 2,3,4,5,-tetra CP, and PCP (penta). Reporting included concentrations of individual chlorophenols.

E-3.6.2.5 Chlorinated Phenoxyacid Herbicides

Chlorinated phenoxyacid herbicides were extracted with the chlorophenols, from the same Florisil tube, with the methanol elution. After concentration, the extract was methylated, cleaned up on Florisil and analyzed by GC/EC. Herbicide compounds which were targeted included 2,4-D and 2,4,5-T.

E-3.6.2.6 Dioxins and Furans

E-3.6.2.6.1 Scope and Application

Total dioxins and total furans were collected using high-volume filtration/adsorption with analysis by gas chromatography/mass spectrometry at the Zenon laboratories in Burlington. Dioxins have been measured in stack emissions from certain combustion sources and documented in the literature. However, it is difficult to detect these compounds at their suspected low levels in ambient air (picograms/cubic metre range or less). More recent analytical techniques indicate that it may be feasible to measure levels as low as 1 pg/m^3. No standard reference method for measuring dioxin compounds in ambient air has been developed. The measurement and analysis outlined are considered developmental in nature. Only three samples were collected and analyzed.

E-3.6.2.6.2 Sampling Method

Sampling was conducted using glass fibre filters to collect dioxins and furans retained on particulate matter followed by a solvent-cleaned XAD_2 adsorbent bed held within a glass cartridge (20/50 mesh, approximately 50 g) to collect vapour phase species that may have been present in air and/or volatilized from particulate matter. High-volume samples were operated for 24-hour periods at a flowrate of approximately 0.6 m^3/min (~20 cfm). Filters were weighed before and after sampling in accordance with methods discussed for total suspended particulate matter (see Section E-3.7).

E-3.6.2.6.3 Analysis Method

The filter and the XAD_2 adsorber were sent to Zenon for analysis by GC/MS multiple ion detection.

E-3.6.2.6.4 Calibration

Conducted as per ASME protocol.

E-3.6.2.6.5 References

Conversations with Rod Thompson at Zenon, March and April, 1986.

Czuczwa, J.M., and R.A. Hites, "Airborne Dioxins and Dibenzofurans: Sources and Fates".

E-3.6.3 Polycyclic Aromatic Hydrocarbons

E-3.6.3.1 Scope and Application

PAH compounds were sampled using high-volume filtration/adsorption with analysis by high performance liquid chromatography (HPLC). Typical urban total PAH concentrations are usually reported to be less than 0.1 $\mu g/m^3$ and often occur in higher amounts in winter than in summer. No standard reference method for measuring PAH compounds has been developed and methods that are often used, employing filtration only, are generally considered to be less than quantitative (i.e., loss of some more volatile species, etc.). Thirteen PAH's are reported, as

follows: fluoranthene, benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, dibenz[ah]anthracene, benz[ghi]perylene, indeno[1,2,3,-od]pyrene, coronene, fluorene, phenanthrene, anthracene and pyrene.

E-3.6.3.2 Sampling Method

Sampling was conducted using glass fibre filters to collect PAH's retained on particulate matter, followed by a solvent-cleaned XAD_2 adsorbent bed held within a glass cartridge (20/50 mesh, approximately 85 g) to collect vapour phase species that may have been present in air and/or volatalized from particulate matter. High-volume samples were operated for 24-hour periods at a flowrate of approximately 0.6 m^3/min (approximately 20 cfm). Filters were weighed before and after sampling in accordance with methods discussed for total suspended particulate matter (see Section E-3.7).

E-3.6.3.3 Analytical Method

Glass fibre filters were extracted with cyclohexane using Soxhlet apparatus, and XAD_2 adsorbers were Soxhlet extracted with cyclohexane. The extracts were then concentrated to dryness and the residue dissolved in a small volume of methanol. Analysis of injected aliquots was done by HPLC with UV detection (Spectra-Physics Model 3500B Liquid Chromatograph) for fluorene, phenanthrene, anthracene and pyrene, and by HPLC-Fluorescence for fluoranthene, benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, dibenz[ah]anthracene, benz[ghi]perylene, indeno[1,2,3-od] pyrene and coronene.

E-3.6.3.4 Calibration

The high-volume sampler containing the adsorbent was calibrated for flowrate in accordance with reference methods (see Section E-3.7.4). Analytical instrumentation was calibrated with a series of thirteen PAH compounds in standard solution that was used for quantification and reporting of individual and total PAH's.

E-3.6.3.5 Interference

It is possible that oxidation of some PAH constituents associated with particulate matter (eg., B[a]P) occurs during sampling upon exposure to high ambient concentrations of ozone and other oxidants.

E-3.6.3.6 References

Barton, S.C., N.D. Johnson, B.S. Das and J.E. Hunt, A Study of Alternatives to High-Volume Sampling for Lubile Constituents of Atmospheric Particulates, ORF Report P-2923/G, June 1979.

Das, B.S. and G.H.S. Thomas, Ontario Research Foundation, Fluorescence Detection in High Performance Liquid Chromatographic Determination of Polycyclic Aromatic Hydrocarbons, Anal. Chem., 50: 967, 1978.

MOE (Ontario Ministry of the Environment), Polynuclear Aromatic Hydrocarbons - A Background Report Including Available Ontario Data, ARB-TDA Report No. 58-79, Sept. 1979.

Guerin, S.G., C.S. Davis and R.B. Caton, Evaluation of Alternatives to Hi-Vol Sampling for Polynuclear Aromatic Hydrocarbons, ARB-120-84-ARSP, A Report Prepared for Ontario Ministry of the Environment, March 1984.

E-3.7 Total Suspended Particulate Matter

E-3.7.1 Scope and Application

The mass concentration of total suspended particulate matter (TSP) in the atmosphere was measured using the standard high-volume sampling method in conjunction with gravimetric analysis. Typical urban/rural TSP concentrations range from 20 to 100 $\mu g/m^3$ which may include particle sizes within the range 0.1 to 100 μm. Standard reference procedures for high-volume sampling have been documented and were utilized.

E-3.7.2 Sampling Method

Air was drawn into a gable covered shelter of the high volume sampler (GMW Model 180 series) at a flowrate of approximately 1.3 m^3/min (45 cfm) through a glass fibre filter by means of a high flowrate blower. Samplers with timers were operated for 24-hour periods and flowrate was maintained constant with the use of a flow controller.

E-3.7.3 Analysis Method

Filters were weighed after conditioning for 24-hours, before and after sampling, using an electronic balance (Mettler Series AC88) equipped with a prefabricated filter holder and chamber that is located in a dedicated weighing room. Concentrations were obtained by dividing the net weight gain of filtered particles by the total air volume sampled.

E-3.7.4 Calibration

The flow controller was calibrated using a conventional orifice with appropriate adjustment of the orifice controller to obtain the desired controlled flowrate.

E-3.7.5 Interferences

Filters subjected to airborne acidic gases such as SO_2, NO_2, etc. during sampling may sometimes experience weight gain due to artifact formation of sulphates and nitrate. This can result from reaction with alkali content of glass fibre but is minimized by the use of acid washed filters of the type selected. Collection efficiency of the sampler is known to be somewhat variable with dependence on wind speed and direction.

E-3.7.6 References

Environment Canada, Standard Reference Method for the Measurement of Suspended Particulates in the Atmosphere (High Volume Method), Report EPS 1-AP-73-2, Jan. 1973.

General Metal Works Inc., Operator's Manual, GMW High Volume Air Samplers.

E-3.8 Fine Particulate Matter

E-3.8.1 Scope and Application

Fine particulate matter of a particle size range less than 10 μm (i.e., considered inhalable) was collected using a size selective inlet (Anderson PM-10) in association with a separate conventional high-volume sampler. Coarse particles were impacted in a chamber of the inlet which permitted collection of fine particles that flowed through the inlet onto filter media. The fine particle fraction of TSP has been found, in recent monitoring networks, to represent approximately 60 to 80% of the total airborne particulate concentration in urban/rural locales.

E-3.8.2 Measurement Method

The size selective inlet was attached to the shelter of a conventional high-volume sampler in place of the gabled roof and the sampler was operated in the normal fashion but at a slightly reduced flowrate (i.e., 40 cfm). Sample collection with glass fibre filters, flow calibration and gravimetric analysis were identical to procedures that were discussed previously (see Section E-3.7).

E-3.8.3 Interferences

Although the filtration media may occasionally be subject to similar artifact formation as mentioned in the previous section, the circular configuration of the inlet minimizes dependencies on wind speed and direction.

E-3.8.4 References

General Metal Works Inc., Operator's Manual, GMW High Volume Air Samplers Model GMWS-2310 ACCU Vol. With Model GMW-310 Controller.

Sierra Anderson, Manual for Model Ultra-Vol UV-10 High Volume PM-10 Sampling System.

E-3.9 Trace Metals

E-3.9.1 Scope and Application

On regular occasions, glass fibre filters used in total and fine particulate samplers were replaced with teflon filters (Toyo Roshi, Polyfon) and analyzed for the following trace metals: Aluminum (Al), Antimony (Sb), Arsenic (As), Boron (B), Beryllium (Be), Bismuth (Bi), Calcium (Ca), Cadmium (Cd), Cobalt, (Co), Chromium (Cr), Copper (Cu), Iron (Fe), Potassium (K), Magnesium (Mg), Manganese (Mn), Molybdenum (Mo), Sodium (Na), Nickel (N), Phosphorus (P), Lead (Pb), Selenium (Se), Silicon (Si), Tin (Sn), Tellurium (Te), Vanadium (V) and Zinc (Zn). Filters were weighed before and after sampling as normally done (see Section E-3.7) in order to also obtain total and fine particulate mass measurements on these occasions.

E-3.9.2 Analytical Methods

The high-volume teflon filters (or portions of them) were digested using 50% Aqua Regia and the resulting solution was diluted to volume for analysis. Analytical methods and detection limits for the trace metals are listed in Table E-1. Methods used include direct current plasma emission, flame atomic absorption or hydride generation and atomic absorption.

E-3.10 Rainfall/Snowfall

E-3.10.1 Scope and Application

Rainfall and snowfall were measured with an electrically heated tipping bucket rain and snow gauge (Weathertronics Model No. 6021-A). Starting in January 1987, total precipitation was also measured using a Nipher shielded precipitation gauge (similar in design to the Atmospheric Environment Services Nipher snow gauge).

E-3.10.2 Sampling

Rain, snow or hail entered the tipping bucket through an 8-inch diameter orifice. Rain funnelled through debris screens into a specially designed surge tank and the flow to the buckets occurred at a constant head. Frozen precipitation was melted before measurement (in the collecting cone and at the orifice). An additional heater warmed the tipping bucket mechanism.

The bucket assembly tips when it has accumulated .25 mm of precipitation. The tipping brings an empty bucket into position and causes a magnet to pass over the reed switch, closing the circuit momentarily. This circuit closure is used to step the output voltage to the data acquisition system, and record a .25 mm value.

The Nipher gauge was designed for cumulative measurement purposes with an antifreeze mixture in winter months to prevent freezing and an oil cap in summer months to prevent evaporation losses. The Nipher snow shield was used in winter to compensate for lighter snow flake resistance to entering the sampler. The wintertime measurements of precipitation by Nipher were expected to be greater than by tipping bucket as heating/evaporation of precipitation losses were eliminated with the Nipher gauge.

E-3.10.3 Typical Performance Characteristics

The following specifications apply to the electrically heated snow and rain tipping bucket system:

Sensitivity:	.25 mm
Resolution:	.25 mm
Accuracy:	0.5% up to 5 cm/hr
Capacity:	Unlimited
Output:	0.1 sec switch closure

E-3.10.4 References

MOE (Ontario Ministry of the Environment), Acidic Precipitation in Ontario (APIOS) - An Overview: The Cumulative Wet/Dry Deposition Network, Report No. ARB-141-85-AQM, APIOS-024-85, October, 1985.

Weathertronics, Manual for Electrically Heated Rain and Snow Gauge, Model 6021-A.

E-3.11 Wet/Dry Deposition

E-3.11.1 Scope and Application

Wet and dry deposition samples were collected with an MIC Type AU Precipitation Collector (Sangamo), which is an all weather sampler that separates wet and dry fall-out of the type used in the M.O.E. Acidic Precipitation in Ontario study network. Samples were primarily analyzed for trace metal content.

E-3.11.2 Sampling

The collector consists of two buckets; one was used to collect precipitation only (wet deposition) and the other was used to collect dustfall during dry conditions (dry deposition). An automatic lid which moves to cover either one or the other bucket was activated and controlled by two precipitation sensors. Upon contact with rain or snow, the dry side of the sampler was automatically covered. When precipitation stopped, a thermister controlled heater evaporated moisture from the sensor and the lid was moved to cover the precipitation collector. The sensor grid heater also provided a means of discriminating against fog or heavy dew and to melt snow and ice depositing on the sensor.

Dustfall and rainwater samples were collected and transported in special 75 ga Nylon/3 mil poly bags that are inserted within the buckets. Collection was in 14" wide by 20" deep bag inserts. Collector bags were removed and replaced during designated station visits (eg., maximum weekly intervals) and after events, until September 1986, from October 1986 onwards the Ontario Ministry of Environment's Cumulative sampling schedule was followed (once every 4 weeks). Samples were stabilized with 2 ml of 5% HNO_3 per 100 millilitres of rainwater and returned to the laboratory for refrigeration at $4^{o}C$ prior to analysis.

E-3.11.3 Analysis Method

Precipitation samples (i.e., weekly collection) were combined on a monthly basis. Samples were primarily analyzed using graphite furnace (flameless) atomic absorption (at Barrenger Magenta Ltd.), for the following trace metal constituents: iron, arsenic, copper, lead, cadmium, chromium, beryllium, nickel and zinc.

E-3.11.4 References

MOE (Ontario Ministry of the Environment), Acidic Precipitation in Ontario Study - AP105 Monthly/28 Day Cumulative, Precipitation, Chemistry Listings, June 1980 - December 1981, ARB-53-83-ARSP, March 1983.

Meteorological Instrument Centre Company, M.I.C. Precipitation, Collector, Type AU, Operator's Manual, May 1984.

E-3.12 Wind Speed and Wind Direction

E-3.12.1 Scope and Application

The Micro Response Wind System (Weathertronics Models 2020, 2023 and 2031) is composed of a wind vane which measured the wind direction, a crossarm, and an anemometer which measured the wind speed.

E-3.12.2 Data Collection

The wind vane consists of an aluminum body, a reinforced, lightweight foam tail and a stainless steel counterweight. As the vane turns, (within the range of 0 to 360°), a potentiometer coupled to the base of a shaft measures the vane movement. After installation onto the tower, the correct orientation was determined and the wind vane was set to True North. No other calibration was necessary.

The anemometer consists of a cup-like and shaft assembly. The main shaft couples directly to a DC generator which produces a voltage that is proportional to the wind speed. This apparatus arrived calibrated from the factory. The wind vane and the anemometer were both mounted onto a cross arm which was then fastened to the weather tower.

E-3.12.3 Typical Performance Characteristics

The wind vane has a .22 m/s threshold for 0-360° and $\pm$2% accuracy in direction. The anemometer cups have a .22 m/s wind speed threshold, operating to within $\pm$1% accuracy at speeds of .22 to 45 m/s (approximately 1 to 160 km/hr).

E-3.12.4 References

Weathertronics, Manual for Micro Response Vane, Model 2020, January 1983.

Weathertronics, Manual for Micro Response Anemometer, Model 2031, January 1983.

Weathertronics, Manual for Crossarm, Model 2023, February 1978.

E-3.13 Air Temperature

E-3.13.1 Scope and Application

Air temperature was measured with a temperature sensor (CAT Model PA2200-17) housed within a motor aspirated radiation shield (Weathertronics Model 8150), at 10 and 30 m above the ground on the meteorological tower.

E-3.13.2 Data Collection

The temperature sensor (a 4" stainless steel tubular probe) consists of a two terminal integrated circuit and transducer which produces output current proportional to the absolute temperature.

The motor aspirated radiation shield consists of a triple cylinder probe shield through which air is drawn by a fan at a rate of 360 ft/min. The air flow ensures that heat absorbed by the cylinder is removed before it can be transferred to an inner cylinder. Radiation baffles were placed at the air intake to reflect any direct radiation away from the probe. The fan discharge was located several feet away from the air intake and directed away so that the generated heat was prevented from affecting ambient temperature measurements. This shield was designed to hold one temperature sensor.

E-3.13.3 Typical Performance Characteristics

Measurement resolution is typically $\pm 0.4^{o}C$ maximum, $\pm 0.2^{o}C$ nominal for a range of air temperatures from -40 to $+60^{o}C$. The radiation error quoted by the manufacturer is $.05^{o}C$ for temperatures within the range of -40 to $+55^{o}C$.

E-3.13.4 References

Weathertronics, Manual for Model 8150-A01, Motor Aspirated Radiation Shield.

Canadian Applied Technology, CAT-2200-17, Temperature Sensor/Interface Specifications.

E-3.14 Solar Radiation

E-3.14.1 Scope and Application

Global solar radiation was measured with a silicon cell pyranometer (Model 3120 Weathertronics).

E-3.14.2 Data Collection

The sensor is a silicon photovoltac cell which absorbs radiation from 0.35 to 1.15 microns. This light energy is converted directly into electrical energy and the resulting output voltage is essentially linear with the light intensity. This instrument was calibrated at the factory before shipping, therefore, no adjustment was needed either before or after installation.

E-3.14.3 Typical Performance Characteristics

Accuracy is to within $\pm 5\%$, with a sensitivity of 50 mV/gm cal/cm^2 min.

E-3.14.4 References

Weathertronics, Manual for Silicon Cell Pyranometer, Model 3120, January 1980.

E-3.15 Upper Air Measurements

E-3.15.1 Scope and Application

Upper air measurements were taken with a minisonde system (Model 3003 Aero-Aqua). This system can measure temperature profiles, mixing heights and upper winds up to a height of 3 km above the surface.

E-3.15.2 Data Collection

The three major components required for a sounding were a flight package (minisonde), a ground receiving station and a single or dual optical tracking system. The sonde measures temperature continuously and transmits it in real time to the ground receiving station. The sonde height and wind profiles are obtained from the data generated by visual tracking of the sonde using theodolite techniques.

Flights were conducted at three hour intervals for two week special study periods (four special studies were undertaken, one each season).

E-3.15.3 Typical Performance Characteristics

The operational minisonde has a differential accuracy of $\pm 0.2^{o}$ for a $20^{o}C$ span, a spatial resolution of 10 m at a rise rate of 3 m/s and a slant range capability of over 10 km.

E-3.15.4 References

Aero Aqua Inc., Preliminary Manual for Minisonde Recorder, Model 4001, used for Model 4002.

Aero Aqua Inc., Preliminary Manual for Minisonde Receiver, Model 3003, February 1981.

E-3.16 Trace Organics - TAGA

E-3.16.1 Scope and Application

Direct air sampling by the computer-controlled TAGA (Trace Atmosphere Gas Analyzer) 6000 System provided on-site environmental analysis of complex chemical mixtures. A broad range of trace compounds if present at the site could be detected, identified and the concentrations measured. Identification was achieved by molecular mass which is characteristic of the compound. Sensitivity for the system was in the parts per billion and parts per trillion ranges.

E-3.16.2 Sampling and Analysis Method

A probe on the roof draws in air samples at a rate of about 1 to 2 L/s. The sampling line runs into a stainless steel cylinder where air samples are subjected to a 6000 volt potential in order to form electrically charged positive and negative ions. After ionization, the ions are drawn into a vacuum chamber where they are separated according to their mass. The detector counts ions as they strike its surface. The output of the detector is then transmitted to the computer system, which is programmed to interpret the mass spectral data and thus identify the individual components present in the sampled air.

The specific organics that the TAGA was detecting are listed below along with the appropriate detection limits:

Acetonitrile	50 ppb	Methyl acrylate	25 ppb
Aniline	20 ppb	Methyl ethyl ketone	10 ppb
Bromochloromethane	50 ppb	Methylene chloride	25 ppb
Benzene	10 ppb	Methylene bromide	25 ppb
Bromodichloromethane	50 ppb	Methyl chloride	25 ppb
Bromomethane	50 ppb	Mercaptans	100 ppb
Carbon tetrachloride	25 ppb	N-Nitroso-dimethylamine	100 ppb
Carbon disulphide	100 ppb	Phenol	100 ppb

Chloroform	25 ppb	Pyridine	20 ppb
Chlorobenzene	25 ppb	Perchloroethylene	25 ppb
Dibromochloromethane	50 ppb	Styrene	10 ppb
Dimethyl sulphide	100 ppb	Tetrachloroethylene	25 ppb
Dichlorobenzenes	25 ppb	1,1,1-Trichlorethane	25 ppb
Dichloroethane	25 ppb	Toluene	10 ppb
1,2-Dichloroethane	25 ppb	Trichloroethylene	25 ppb
Dioxane	25 ppb	Toluene di-isocyanate	50 ppb
1,2-Dibromomethane	25 ppb	Vinyl Chloride	25 ppb
Ethyl Acrylate	20 ppb	Vinylidene Chloride	25 ppb
		Xylene	10 ppb

E-3.16.3 References

Lane, D.A., "Mobile Mass Spectrometry", Environ Sci. Tech., 16(1), 1982.

TRC Advanced Analytics Inc., Letter to Monika Dobson dated October 23, 1985 Regarding TAGA System Including Marketing Literature "Characterization of Ambient Air Quality".

SCIEX, Product Note, Mobile TAGA 6000 MS/MS Laboratory 1983.

E-3.17 Data Acquisition

E-3.17.1 Scope

The data acquisition system received the electrical signals from the continuously recording air quality and meteorological monitors or sensors, and stored the data at the site until interrogated by the central control computer through dedicated phone lines. This system included a Mandel Data Taker remote telemetry unit located on-site, dial up phone connections (through modems), an IBM Personal Computer (for use with both automatic and interactive commands) (at ORF) and a VAX (at ORF) to process the incoming data.

E-3.17.2 Definition

The Data Taker is a data collection terminal which provides limited on-site data storage. Software on the datataker allows for flagging of data and switching to battery backup in case of power failure. The data on the Data Taker was downloaded to the IBM PC once every 24 hours at midnight, and stored on floppy disk.

The ORF VAX computer was used to create historical data files, undertake data assessments and create the required reports. Data from the IBM PC disks were transferred to the VAX at regular intervals to create hourly average data files for each parameter on a monthly basis. These data files then formed the basis of computations which generated daily averages, monthly averages, diurnal profiles, exceedance summaries, directional distributions, frequency distributions and those correlations of interest.

E-3.17.3 References

Data Taker, Manual, 1986.

E-4.0 REPORTING

The data acquisition system collected and compiled the data continuously. At the end of each month, monthly summaries were prepared. Quarterly interim reports incorporated and interpreted these monthly summaries, with more detailed hourly values studied in the case of anomalies.

At the conclusion of one year of monitoring, the baseline report contained detailed descriptions of the climatology, meteorology, and air quality at the site during the baseline study period. Seasonal variations, as well as any specific features which emerged from the study, were highlighted.

Prevailing meteorological conditions were compared with long-term averages from the nearest airport recording these parameters and the air quality data were discussed and summarized. This report forms the official documentation of "background" levels at the site.

TABLE E-1

Summary of Analytical Methods and Detection Limits (µg/filter) Used for Analysis of Trace Metals Associated with Total and Fine Particulates Collected at OWMC Preferred Site from June 1986 to May 1987

Element	Method	Detection Limit*
Al	DCP	0.6
As	HGAA	0.02
B	DCP	1.2
Be	DCP	0.1
Bi	DCP	12.0
Ca	DCP	3.0
Cd	FAA	0.1
Co	DCP	0.6
Cr	DCP	0.6
Cu	DCP	0.6
Fe	DCP	1.2
K	FAA	30.0
Mg	DCP	0.6
Mn	DCP	0.6
Mo	DCP	3.0
Na	DCP	60.0
Ni	DCP	0.6
P	DCP	30.0
Pb	FAA	3.0
Sb	HGAA	0.02
Se	HGAA	0.02
Si	DCP	3.0
Sn	DCP	1.2
Te	HGAA	0.02
V	DCP	1.2
Zn	FAA	1.2

Notes:

DCP - Direct Current Plasma emission
FAA - Flame Atomic Absorption
HGAA - Hydride Generation and Atomic Absorption
*Detection limits are dependent upon the percentage of filter used and final volume.

FIG. E-1
OWMC PREFERRED SITE MONITORING STATION LOCATION

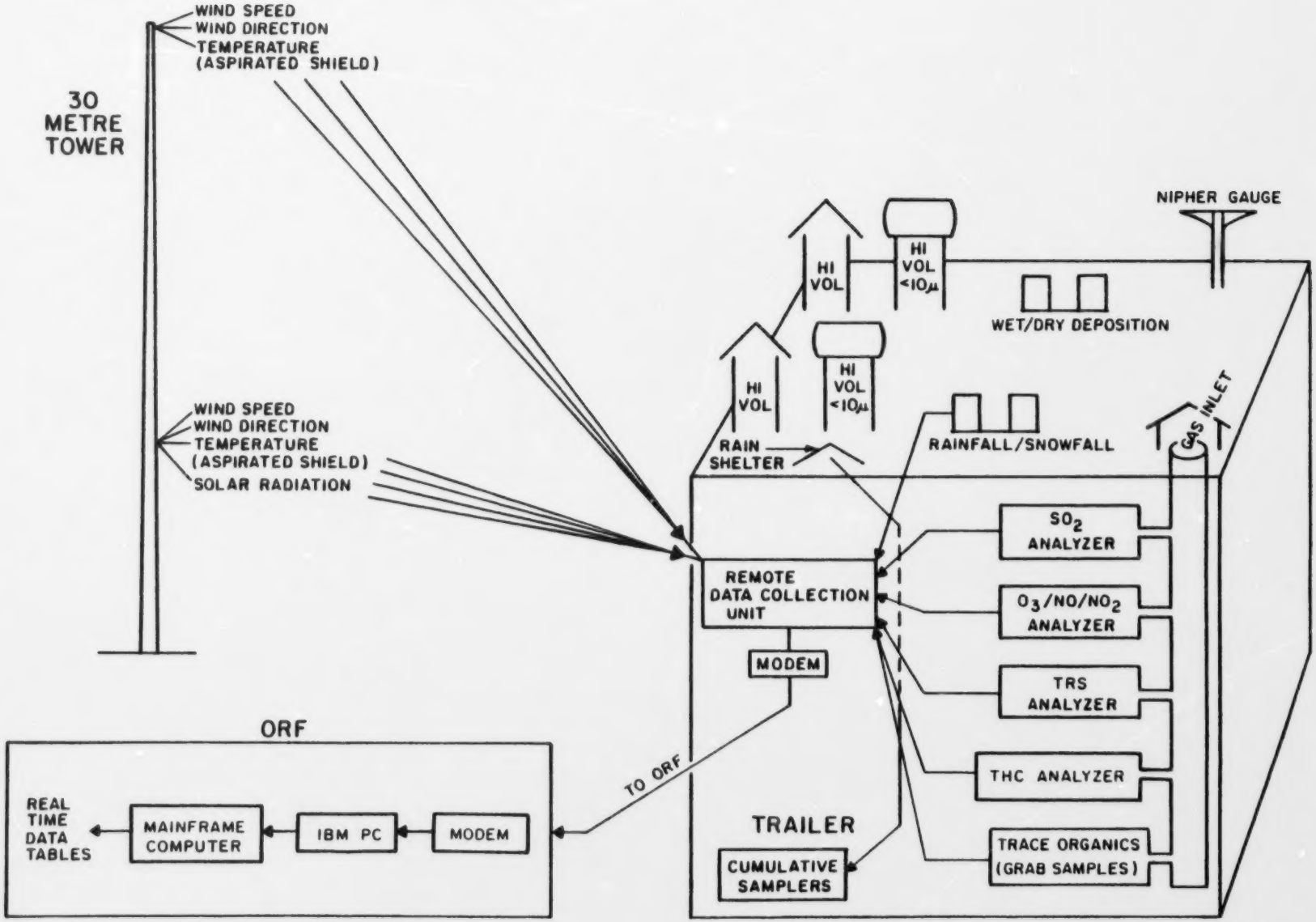

FIGURE E-2 : MONITORING CONFIGURATION AT PREFERRED SITE.

Volume

3

Final report

OWMC
Ontario
Waste Management
Corporation

A provincial crown corporation.

ONTARIO RESEARCH FOUNDATION

SITE ASSESSMENT
PHASE 4B:
ATMOSPHERIC CONDITIONS
VOLUME 3 - APPENDIX F

Prepared for
The Ontario Waste Management Corporation

Submitted By

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Ontario Research Foundation

October, 1987

APPENDIX F

RESULTS OF BASELINE AIR QUALITY AND METEOROLOGICAL MONITORING

F-1. INTRODUCTION

This appendix summarizes the data collected during the one year baseline air quality and meteorological monitoring program at the OWMC preferred site in the Township of West Lincoln. The primary purpose of the monitoring program was to assess the existing air quality and meteorological conditions at the preferred site as part of the environmental impact assessment that is being undertaken. The air quality monitoring program focused upon air quality parameters that may be relevant to the construction and operation of the proposed facility. The meteorological measurements served to document the dispersive capacity of the local atmosphere. The data collected was used to supplement relevant information available from the literature (ORF, 1984) and to confirm information used in the Phase 4A site selection studies (ORF, 1985).

F-2. SCOPE OF WORK

F-2.1 Baseline Programme

One air quality and meteorological monitoring station was established on the OWMC preferred site at West Lincoln. This program was conducted for a period of one year. The originally planned one-year period was extended by three months to obtain a more complete data set due to incomplete records during start-up of the station. Annual averages reflect the final 12 months (June 1986-May 1987) while maximum and minimum values cover the complete 15 month period. The more common "criteria" air pollutants were measured continuously. These are:

- sulphur dioxide (SO_2),
- nitrogen oxides (NO, NO_2 and NO_x),
- ozone (O_3),
- total reduced sulphur (TRS), and
- total hydrocarbons (THC).

In addition, the following were monitored for 24-hour periods every third day:

- total suspended particulate levels (TSP),
- fine particulate levels (FP).

Certain trace metals, and inorganic and organic compounds were measured periodically by cumulative 24-hour sampling. These constituents were selected in terms of toxicity and probability of occurrence in emissions from the OWMC facility. These included aluminum, antimony, arsenic, beryllium, bismuth, boron, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, molybdenum, nickel,

phosphorus, potassium, selenium, silicon, sodium, tellurium, tin, vanadium, zinc, fluorides, chlorides, polychlorinated biphenyls, chlorophenols, chlorobenzenes, organochlorine pesticides, chlorinated phenoxyacid herbicides, dioxins, furans, and polycyclic aromatic hydrocarbons. As well, a scan of over 70 other organic compounds was conducted once per season (for the first three seasons) by the mobile TAGA 6000. Compounds were chosen to include those which may be present in the waste received at the facility, and thus potentially emitted from the incinerator stack or as volatile fugitive emissions. Wet deposition was measured on a monthly basis and analyzed for trace metals including arsenic, beryllium, cadmium, chromium, copper, iron, lead, nickel and zinc.

The following meteorological parameters were measured continuously on a 30 m tower located at the monitoring site:

- wind speed (at 10 m and 30 m above ground level)
- wind direction (at 10 m and 30 m above ground level)
- air temperature (at 10 m and 30 m above ground level)
- solar radiation (at 10 m above ground level).

In addition, rainfall and snowfall were measured. Periodic meteorological studies were undertaken each season to measure representative mixing height and upper air stability and wind conditions using minisondes.

The continuously recorded air quality and meteorological parameters were collected and automatically transmitted to the Ontario Research Foundation (ORF) computers on a real-time basis.

F-3. METEOROLOGY

F-3.1 Continuous Ground Level Measurements

Measurements of the critical meteorological parameters were made at heights of 30 and 10 m, as part of the one year baseline studies at the OWMC preferred site meteorological and air quality monitoring station. These include wind speed, wind direction and air temperature. Solar radiation was measured at the 10 m height on the tower, while precipitation measurements were made on the roof of the trailer.

F-3.1.1 Wind Speed and Direction

Wind speed and direction were measured simultaneously at heights of 10 m and 30 m on the meteorological tower. Tables F-1 to F-48 inclusive, present these data for the months of June 1986 through May 1987.

The annual predominant wind direction at both heights was SW. The next most predominant wind directions in descending order for both heights were WSW and W. The calm portion of winds was defined as less than 2 km/hr and occurred for 6.8 and 5.3% of the recorded data at 10 and 30 m, respectively. Loss of record data occurred 3.5% of the time at 10 and 30 m.

Table F-49 gives the predominant wind directions at 10 and 30 m and in chronological order. Other predominant wind directions presented represent frequencies of 10% of the time or more. The percentage of

measured data that was calm or variable also were indicated for each month. The majority of the predominant indicated wind directions were SW with WSW winds in December and January at 10 and 30 m, W winds in November at 30 m, NNE winds in March and NE winds in April. Calm conditions occurred from 1.6 to 17.5% of the measured data at 10 m and between 0.6 and 10.6% of the measured data at 30 m. During the summer months, 80 to 99% of the data were valid and for fall, winter and spring valid data recovery for both heights were 99% or greater. Table F-50 gives percentages of valid data for all 16 compass points, variable winds and calm conditions for all 4 seasons and annual values for both heights. The predominant wind direction for each season at both heights was:

- SW for summer and fall,
- WSW for winter, and
- NE as well as SW for spring.

The majority of the winds were southerly and westerly, with another significant component from the north to northeasterly directions. Winds which were considered variable (varying greater than 90° for over 45% of the hour) and wind speeds less than 2 km/hr were noted as calm. Overall, the calm conditions occurred less frequently at 30 m than at 10 m.

The annual average wind speeds at 10 and 30 m were 9.9 and 13.4 km/hr, respectively. The maximum hourly average wind speeds observed were 44 km/hr at the 10 m level and 59 km/hr at the 30 m level.

Seasonal averages ranged from 8.0 to 14.4 km/hr with the warmer months having lower average wind speeds and no apparent pattern existing for maximum hourly average wind speeds. Table F-51 gives the monthly, seasonal and annual average wind speeds and maximum hourly wind speeds observed for both 10 and 30 meters.

During the majority of August, the 30 m sensor was not functioning due to electrical storm damage. For the rest of the time, the valid data ranged from 75 to 100% with several months at both heights being 100% valid.

F-3.1.2 Air Temperature

Air temperature was measured at heights of 10 m and 30 m on the meteorological tower using two temperature sensors housed within motor aspirated shields. Tables F-52 to F-87, inclusive, present the temperature for June 1986 to May 1987 representing the two heights. The annual average temperatures recorded were 7.4 and 9.2^{o}C for 10 and 30 m, respectively. The mean temperature difference was .19°C greater at 30 m than 10 m. The annual averages are weighted more towards winter with much of the summer data missing for 10 m due to a recurring malfunction of the sensor. Temperature difference calculations were made only when both sensors were operational.

Table F-88 summarizes the monthly and seasonal averages, highs and lows for temperature at 10 and 30 m for the baseline period. The seasonal averages ranged from -2.3 to 19.8^{o}C and monthly averages ranged from -3.6 to 20.7^{o}C.

Less than 80% of the data recorded in July and August at 10 m was valid due to instrument problems. All other months for both heights recorded from 89 to 100% valid data. Table F-89 summarizes the monthly and seasonal averages, high and low values for temperature difference between 30 and 10 m during periods when both sensors were operational. Monthly mean temperature differences varied from -.5 to .4°C.

F-3.1.3. Solar Radiation

Incoming solar radiation was measured with a silicon cell pyranometer situated at the 10 m height on the tower. Tables F-90 to F-101 document the levels recorded for June 1986 through May 1987. For all 12 months data was 96% to 100% valid. Hourly values were 0 Wm^{-2} at night with seasonal maxima of 1096, 813, 558 and 904 Wm^{-2} near midday in June and September of 1986, and February and May 1987, respectively for the four seasons.

F-3.1.4 Precipitation

Rainfall and snowfall were measured with an electrically heated tipping bucket rain and snow gauge. Tables F-102 to F-113 present the total precipitation amounts measured for the period June 1986 to May 1987. Table F-114 summarizes the monthly and seasonal amounts of total precipitation recorded for each month at both the site and at Mt. Hope Airport for comparison purposes. The rainfall amounts recorded for the warmer months often consisted of short term events, with events in the cooler months lasting longer periods of time generally. It was realized that the heated tipping bucket is likely to underestimate snowfall amounts due to evaporation of snowfall from the heated collection cone portion of the sampler. Therefore, a Nipher snow gauge was installed at the site in late January. During station visits the Nipher gauge was monitored according to the Ontario Ministry of the Environment Wet Deposition Network timetable with measurements every 4 weeks starting in late January. For each 4 week period ending on February 24, March, 24, April 21 and May 19, the heated tipping bucket recorded totals of 2, 14, 68 and 15 mm of precipitation while the Nipher Gauge recorded 11, 18, 87 and 22 mm of precipitation, respectively.

F-3.2 Upper Air Studies

Upper air measurements of wind and temperature profiles were taken at the site with a minisonde system and a single theodolite. The spring study lasted from April 1 to April 14, 1986 (inclusive) with minisonde flights run every 3 hours (8 flights daily). The summer study lasted from July 1 to July 19, 1986 with a number of flights missed due to equipment malfunctions. These were made up at the end of the scheduled 2 week period. The fall study lasted from October 6 to October 20, 1986. For 4 days during the study, the minisondes were sighted with double theodolites during daylight hours in an attempt to determine the mean ascent rate for the system. The (weighted) mean rate of ascent was 2.7 meters per second with a standard deviation of 0.55. A rate of 3.0 meters per second was assumed for all other minisonde releases based on manufacturer's suggestions. The winter study lasted from January 6 to January 20, 1987, with several flights missed due to severe winter storms. These were not repeated at the end of the study due to equipment failure.

F-3.2.1 Mixing Heights/Lapse Rates

Mixing heights were determined from the minisonde temperature profiles obtained for each flight. In Appendix F-1, Figures 1-61 illustrate the temperature profiles measured during the April, July, October and January studies, while Tables F-115 to F-118 summarize the mixing heights for each flight. The mixing height was defined as the level at which the air temperatures started to increase with height.

In most cases the mixing heights were zero at night (stable air near the surface due to the ground cooling). In some instances, however, larger scale weather systems influenced near-ground conditions. For

example, strong low-level winds would prevent a night-time stable layer from forming. In these cases, it was assumed that neutral conditions prevailed and a mixing height is distinguishable in only some cases.

Daytime mixing heights varied seasonally, with maximum values of greater than 5000 m recorded at midday during the summer and fall. Mixing layer formation began just before or after 0700 Local Standard Time (LST) in most cases and had dissipated or started to dissipate by 1900 LST.

Lapse rates or temperature variations with height were used to determine atmospheric stability class in the mixing layer. These are indicated in Tables F-115 to F-118 as S (stable), N (neutral) and U (unstable).

F-3.2.2 Upper Winds

Upper wind speeds and directions were derived using the theodolite readings obtained during each flight at vertical intervals of 90 m. The manufacturer's ascent rate of 3 m/s was used for these calculations. In some cases low lying fog or heavy rain prevented any visual tracking of the balloon or restricted it to the first few hundred metres of the atmosphere.

F-4. AIR QUALITY

F-4.1 Continuous Measurements - Criteria Pollutants

The pollutants which were measured on a continuous basis at the monitoring site are sulphur dioxide, nitrogen oxides and ozone, total reduced sulphur, total hydrocarbons, and both total and fine suspended particulates.

F-4.1.1 Sulphur Dioxide

Sulphur dioxide was measured continuously using a pulsed fluorescent ambient SO_2 monitor. Tables F-119 to F-130 summarize the levels measured for June 1986 to May 1987.

The annual average was 4.7 ppb (1 ppb SO_2 = 2.62 $\mu g/m^3$ SO_2) with minimum and maximum hourly average readings of 0 and 106 ppb. Table F-131 summarizes the monthly and seasonal averages, and maximum and minimum values for SO_2. The seasonal averages ranged from 3.9 to 6.1 ppb and monthly averages ranged from 3.1 to 7.1 ppb.

Literature values from Appendix H indicate maximum hourly readings of 80 ppb and 2270 ppb were recorded at Niagara Falls and Thorold, Ontario over a much longer collection period (1980 to 1985), with mean annual levels of 5 to 44 ppb recorded at those and other Niagara Peninsula locations in 1985. Valid data ranged from 80 to 95%. Invalid data were a result of equipment malfunctions and daily automated span and zero checks.

F-4.1.2 Nitrogen Oxides and Ozone

Nitrogen oxide (NO), nitrogen dioxide (NO_2), total nitrogen oxides (NO_x) and ozone (O_3) were sequentially measured with a chemiluminescent analyzer with three distinct cycles. The first two cycles measure NO and NO_x (and NO_2 is taken as the difference of these) while the third cycle measures O_3. Tables F-132 to F-179, inclusive provide hourly levels of these four pollutants for June 1986 to May 1987.

The annual average NO was 1.9 ppb (1 ppb NO = 1.22 $\mu g/m^3$ NO). The annual average NO_2 and NO_x were 11.0 and 12.3 ppb (1 ppb NO_2 = 1.88 $\mu g/m^3$ NO_2). The annual average O_3 was 28.4 ppb (1 ppb O_3 = 1.96 $\mu g/m^3$ O_3). Annual minimum hourly average records were 0 for all four parameters, and the maximum values were 119, 57, 160 and 121 ppb for NO, NO_2, NO_x and O_3, respectively. Table F-180 summarizes the monthly and seasonal averages, highs and lows for nitrogen oxides. The seasonal averages for NO_x were 4.7, 10.8, 19.2 and 14.1 ppb for summer 1986, fall 1986, winter 1986-1987 and spring 1987, respectively. Monthly averages ranged from 2.7 to 19.7 ppb with the summer months having the lowest averages and winter months the highest.

Table F-181 summarizes the monthly and seasonal averages, highs and lows for ozone. The seasonal averages for O_3 were 31.5, 22.5, 21.0 and 37.3 ppb, for summer 1986, fall 1986, winter 1986-1987 and spring 1987, respectively and monthly averages ranged from 15.1 ppb in December to 44.5 ppb in May.

Literature values from Appendix H indicate that maximum hourly concentrations of approximately 140 ppb for the nitrogen oxides, and 123 ppb for O_3 have been measured in other rural areas, while annual averages of 3 to 18 ppb (NO_x) and 24 to 34 ppb (O_3) have been reported (1980 to 1985).

NO, NO_2, NO_x and O_3 missing data were primarily a result of daily zero and span checks and several major equipment failures, the largest of which was caused by an electrical storm in late September. Valid data ranged from 64 to 90%.

F-4.1.3 Total Reduced Sulphur

Total reduced sulphur compounds (TRS), which consist primarily of hydrogen sulphide (H_2S), were measured continuously with a pulsed fluorescent ambient SO_2 monitor fitted with a catalytic converter to convert reduced sulphur compounds to SO_2. Tables F-182 to F-193, inclusive provide the mean hourly measurements of TRS for June 1986 to May 1987, respectively.

The annual average was 0.2 ppb (1 ppb H_2S = 1.39 $\mu g/m^3$ H_2S), with minimum and maximum hourly average readings of 0 and 4 ppb. Table F-194 summarizes the monthly and seasonal averages, highs and lows, for TRS. The seasonal averages ranged from .2 to .3 ppb with monthly averages ranging from .1 to .5 ppb.

Literature values from Appendix H report maximum hourly readings of 14 to 90 ppb with annual averages of .1 to 1.1 ppb in rural areas from 1980 to 1985. Valid data ranged from 85 to 97% of the time over the 12-month period. Daily span and zero checks as well as electrical storm damage to the data acquisition system contributed to loss of data.

F-4.1.4 Total Hydrocarbons

Total hydrocarbons were measured during the months of August and October of 1986. Tables F-195 and F-196 show data collected. Monthly averages were 166 and 175 pphm (parts per hundred million) (1pphm THC as CH_4 = 6.55 $\mu g/m^3$ THC as CH_4) for August and October, respectively. Maximum and minimum recorded levels were 342 and 309 pphm and 74 and 85 pphm for August and October, respectively. Annual mean values of near 200 pphm have been measured at other stations in the Niagara Peninsula (hourly maximum value of 1700 pphm) (See Appendix H). Recurrent analyzer procurement and repair problems occurred and in late October, a decision was made to discontinue monitoring this parameter in favour of other more specific forms of hydrocarbon measurement.

F-4.1.5 Total and Fine Suspended Particulates

Total suspended particulate matter (TSP) was measured using standard 24-hour high volume sampling methods in conjunction with gravimetric analysis. Fine particulate matter (FP) (i.e., particle size range <10 μm) was collected using a size selective inlet mounted on a second high volume sampler. This fine fraction usually constitutes about 60 to 80% of the total airborne particulate matter, and represents the inhalable size range of particles.

Table F-197 provides the concentrations of both total (TSP) and fine (FP) particulates obtained every 3rd day including seasonal and annual means are also included in this table Annually, the numbers ranged from 3 (April 1986) to 123 $\mu g/m^3$, with annual geometric means of 29 and 22 $\mu g/m^3$ for TSP and FP, respectively. The seasonal geometric means for TSP were 35, 26, 25 and 30 $\mu g/m^3$ for the summer 1986, fall 1986, winter 1986-1987 and spring 1987, while the fine fractions measured were 26, 21, 21 and 20 $\mu g/m^3$ for the same seasons. Greater than average amounts of precipitation measured during the baseline study resulted in lower than average levels measured (i.e., particulate levels in rural regions can be expected to be somewhat higher; see Appendix H). The annual arithmetic means for TSP and FP were 33 and 25 $\mu g/m^3$, respectively. Seasonal means of 39, 29, 28 and 30 $\mu g/m^3$ were recorded for TSP, and 31, 23, 23 and 23 $\mu g/m^3$ for FP, for the summer 1986, fall 1986, winter 1986-1987 and spring 1987 seasons. Percent fine fractions varied from 34 (Spring 1986) to greater than 100%, but were generally in the 60 to 80% range.

F-4.2 Cumulative Sampling

All cumulative sampling was carried out over 24-hour sampling periods on designated days (every 18th day). Blanks were submitted for analysis for all constituents, and the mean annual blank level was subtracted from the sampling results for the entire year. If the blank level was less than the detection limit, a value of half the detection level was assumed. Similarly when computing arithmetic and geometric means, half of the detection limit value was assumed if the result was non-detectable.

Several of the sampling and analytical techniques are experimental in nature, i.e., no standard methods exist for these pollutants. However, a program of methods development was implemented

and in most cases a satisfactory method of analysis resulted. All of the methods used to sample and analyze for the various pollutants measured are outlined in detail in Appendix E.

Cumulative sampling was undertaken for fluorides, chlorides, total mercury, polychlorinated biphenyls (PCB's), chlorobenzenes, chlorophenols, organochlorine pesticides, chlorinated phenoxyacid herbicides, dioxins, furans, and polycyclic aromatic hydrocarbons (PAH's). Rain samples were analyzed for trace metals. As well, trace metals were measured in particulate loadings (both TSP and FP).

F-4.2.1 Fluorides and Chlorides

Particulate and gaseous fluoride-, chloride- and cyanide-containing compounds were collected on two impregnated filters (one for particulate and one for gaseous phase) within a single filterpack. Table F-198 provides a summary of the concentrations measured during the summer 1986, fall 1986, winter 1986-1987 and spring 1987 seasons. Cyanide analyses were discontinued due to difficulties in the analytical method, and the fact that there was no cyanide detected on the first six samples. Chloride levels ranged from non-detectable to 1.59 $\mu g/m^3$. Total fluoride levels of non-detectable to 1.46 $\mu g/m^3$ (the latter in November) were measured. Literature value levels of 1.5 to 2.0 $\mu g/m^3$ (rural) for chlorides and .01 to 13.2 $\mu g/m^3$ fluorides (urban) have been reported (see Appendix I).

F-4.2.2 Total Mercury

Total mercury was collected with a cumulative low-volume sampling system comprised of a pre-filter, a pyrolyzer to convert gaseous mercury

compounds to elemental mercury vapour, and silver amalgamation tubes to adsorb elemental mercury vapour. Table F-199 provides a summary of the results (non detectable to 20.5 ng/m^3) after extensive precleaning was carried out. Literature values ranging from 2 to 7 ng/m^3 have been measured at other rural sites (from Appendix I).

F-4.2.3 PCB's (Polychlorinated Biphenyls)

PCB's were measured on 12 sampling days from August 1986 to March 1987, using the MOE's procedure to sample and analyze for these compounds (MOE, 1984). 24-hour samples were collected on precleaned, pretreated Florisil tubes. The analysis was done on a dual column GC for 30 PCB congeners. If a congener was present on both columns, the lowest value was assumed. If a congener was present on only one column, interference was assumed, and the value was not considered. Table F-200 summarizes the results for the samples. Levels in the range of non-detectable (less than .009 ng/m^3) to 0.07 ng/m^3 were measured (after blanks were subtracted). For most of the congeners, however, it is evident from Table F-200 that no amounts were detected once blank levels were subtracted. Values ranging from .1 to 23 ng/m^3 have been reported in the literature (rural locations; see Appendix I).

F-4.2.4 Chlorobenzenes

Florisil cartridges used for PCB determination were also analyzed for airborne chlorobenzenes (10 chlorobenzenes from di to hexa). Table F-201 summarizes the results. Values measured were generally below the detection limits for the di-chlorobenzenes, ranged from non-detectable to 1.2 ng/m^3 for the tri-chlorobenzenes, and were essentially non-detectable to 0.1 ng/m^3 for the tetra, penta, and hexa-chlorobenzenes. Urban levels of chlorobenzene have been reported in the range of non detectable to 1.0 μg/m^3 (see Appendix I).

F-4.2.5 Chlorophenols

Separate Florisil cartridges were used for the collection of chlorophenols (and chlorinated herbicides) during the 12 sampling days. Table F-202 indicates that no chlorophenols were detected. The detection limits of <.10 and <.005 $\mu g/m^3$ are many orders of magnitude below the 24-hr air quality standard for pentachlorophenol of 20 $\mu g/m^3$. Urban literature values for this compound have quoted levels near the detection limits of this study (see Appendix I). As there are no standard analytical methods in place for chlorophenols, the analysis undertaken was developmental in nature. However, the fact that the detection limits are several orders of magnitude below the air quality objective should be sufficient to qualify the results.

F-4.2.6 Organochlorine Pesticides

Florisil cartridges used for PCB's and chlorobenzenes were also analyzed for DDT, DDD, Dieldrin, Endrin, Heptachlorepoxide, Hexachlorocyclohexane, Chlordane, Methoxychlor, and Mirex. All of the tubes analyzed reported either non detectable, or were near the detection limits, as indicated in Table F-203. The highest OC pesticide level measured was 0.14 ng/m^3 (measured October 2). Appendix I provides literature values of pesticides measured in ambient air. DDT has been reported at .01 to .05 ng/m^3 (rural). Dieldrin has been reported from .01 to .1 ng/m^3 (rural) and Endrin reported at 2.3 to 59 ng/m^3 (rural). Chlordane has been reported at levels from .01 to .05 ng/m^3 (rural).

F-4.2.7 Chlorinated Phenoxyacid Herbicides

Chlorinated phenoxyacid herbicides were extracted with the chlorophenols, from the same Florisil tubes. Herbicide compounds targeted were 2,4-D

and 2,4,5-T. Essentially the results were non-detectable, as indicated in Table F-204. A rural literature value of 4 ng/m^3 was reported for 2,4,D (see Appendix I).

F-4.2.8 Dioxins and Furans

Dioxins and furans were sampled with high volume samplers using filters and XAD-2 resin (as backup). Three samples were collected and analyzed for tetra, penta, hexa, hepta, and octa-chlorodibenzo(p)dioxins, and tetra, penta, hexa, hepta, and octa-chlorodibenzofurans by Zenon Environmental Inc. (see Table F-205). The results indicated non-detectable levels for most isomers with the exception of 0.4 pg/m^3 octachlorodibenzo(p)dioxin measured on Oct. 2, 1986 and 0.2 pg/m^3 tetrachlorodibenzofuran measured on August 28, 1986. The measured value of dioxins is several orders of magnitude below the regulated levels, and literature values are not available for comparison. Due to the extremely small quantities that these levels represent, and the fact that they are near the detection limits, it is questionnable whether any real levels were measured at the site. The study was discontinued for this reason as well as the extremely high cost of analysis.

F-4.2.9 PAH's (Polycyclic Aromatic Hydrocarbons))

Thirteen PAH compounds were sampled using high-volume filtration/ adsorption with analysis by high performance liquid chromatography (HPLC). Table F-206 provides the results from the samples taken during all four seasons. Samples were collected on glass fibre filters to collect the particulate fraction, followed by a solvent-cleaned XAD_2 adsorbent bed held within a glass cartridge to collect the vapour fraction. The results from analysis of the 2 sampling media have been

added to present the result as total PAH, for each of the 13 PAH's. Levels measured for the individual PAH's rarely exceeded 1 ng/m^3 on any sampling day for Fluoranthene, Benzo(a)Anthracene, Benzo(b)Fluoranthene, Benzo(k)Fluoranthene, Benzo(a)Pyrene, Dibenz(ah)Anthracene, Benz(ghi)Perylene, Indeno(1,2,3-od) Pyrene, and Coronene. As levels recorded for Coronene in the early part of the study were non-detectable, this PAH was not reported for the remainder. Levels for Fluorene varied from non-detectable to 18.2 ng/m^3; levels for Phenanthrene ranged from 0.2 (Spring 1986) to 50.7 ng/m^3 (Spring 1986); levels for Anthracene ranged from non-detectable to 15.7 ng/m^3; and levels for Pyrene ranged from non-detectable to 44.5 ng/m^3. Literature values (see Appendix I) for PAH's ranged from .0003 to .093 μg/m^3 (urban) for Fluoranthene and were reported at .000144 μg/m^3 for Benzo(a)Pyrene.

F-4.2.10 Wet Deposition

Wet deposition precipitation samples were collected with a Sangamo precipitation collector. Collector bags were removed and replaced during station visits and after events, and composited to make up a monthly sample. This sample was analyzed for the following trace metals: arsenic (As), beryllium (Be), cadmium (Cd), chromium (Cr), copper (Cu), iron (Fe), lead (Pb), nickel (Ni) and zinc (Zn). Table F-207 presents the monthly results. Non-detectable levels were measured for arsenic and beryllium. Cadmium levels ranged from non-detectable to 1.2 μg/l of water; nickel levels from non-detectable to 5.5 μg/l; chromium levels from non-detectable to 18.5 μg/l; copper levels from non-detectable to 14.6 μg/l; iron levels from non-detectable (spring 1986) to 270 μg/l; lead levels from non-detectable to 12.5 μg/l and zinc levels from non detectable to 209 μg/l.

F-4.2.11 Trace Metals

Teflon filters were used on the total and fine particulate samplers every 18th day, and analyzed for the following trace metals: aluminum (Al), antimony (Sb), arsenic (As), beryllium (Be), bismuth (Bi), boron (B), cadmium (Cd), calcium (Ca), chromium (Cr), cobalt (Co), copper (Cu), iron (Fe), lead (Pb), magnesium (Mg), manganese (Mn), molybdenum (Mo), nickel (Ni), phosphorus (P), potassium (K), selenium (Se), silicon (Si), sodium (Na), tellurium (Te), tin (Sn), vanadium (V) and zinc (Zn). Table F-208 lists the concentrations as well as calculated means for the entire baseline period. Several of the metals were not detectable or were below the detection limits. The possibility of copper contamination from the hi-vol motors prompted the installation of flexible tubing to vent the exhaust air well away from the air intake. This was installed by July 1, 1986; the values for copper before that time have not been presented.
It should also be noted that the As and Se levels presented could be underestimated due to the possibility of volatilization of these elements from the filters. Standard methodology for capturing the gaseous phase of these elements is not in place to date. The annual geometric means and maximum values observed at the OWMC site and at various locations in the Niagara peninsula area are listed in Table F-209.

F-4.3 Mobile Trace Organic Study

Real time air sampling for trace organics was conducted at the site each season using the mobile TAGA 6000 with the Low Pressure Chemical Ionization (LPCI) source. Qualitative and quantitative screens for compounds of interest listed in the Protocol Document (Appendix E) were undertaken at 2 sites; at the meteorological and air quality monitoring station and at a second location approximately 50 m south of Highway 20, on Schram Road.

The target compounds of the survey were predominantly from the alkane, alkene, aromatic and ketone classes. The only detectable compounds noted were 2 aromatics, namely benzene and toluene at 4 ppb (1 ppb benzene = 3.19 $\mu g/m^3$ benzene) and 5 ppb (1 ppb toluene = 3.76 toluene $\mu g/m^3$) respectively, at the Schram Road site during the April 12, 1986 study. These results are consistent with the close proximity of vehicular traffic. Literature values (see Appendix I) for benzene are reported from .7 to 7 $\mu g/m^3$ (rural) and for toluene from 1.8 to 12 $\mu g/m^3$ (rural). There were no detectable levels measured at the other site in April, or at either site during the July and October 1986 surveys. Following these results, and the fact that the MDS Analytics TAGA was not available after October, the January 1987 survey was not undertaken. Details of the April, July, and October studies are presented as Appendix F-2.

F-5. CONCLUSIONS

Air quality and meteorological data for the baseline monitoring program at the OWMC site were collected for the months of March 1986 to May 1987, inclusive. Start-up problems resulted in significant data gaps for many pollutants. Therefore, it was decided to start the "official" baseline study in June 1986. The data have been tabulated and reported for each parameter for the latest 12 months (June 1986 to May 1987). However, in determining maximum values the entire 15 month period was considered where available. In general, levels measured at the OWMC preferred site during the baseline study were found to be within expected ranges for a rural location in Southern Ontario.

F-6. REFERENCES

MOE (Ontario Ministry of the Environment), 1984, "Method for Sampling and Analysis of Polychlorinated Biphenyls in Ambient Air, Report AMP-137.

ORF, 1985, Site Selection Process, Phase 4A: Selection of a Preferred Site(s) - Atmospheric Considerations.

ORF, 1984, Site Selection Process, Phase 3B: Selection of Candidate Sites; Atmospheric Considerations.

TABLE: F-1

OWMC AIR POLLUTION SURVEY

MET. DATA WIND DIRECTION-10m

UNITS PT. OF COMPASS

STATION LINCOLN COUNTY

MONTH JUN 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	
2	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	N	N	N	N	N	N	NNW	N	NNE	
3	C	C	C	C	C	C	C	C	****	****	****	****	****	****	****	****	****	****	****	****	****	C	C	C	
4	C	****	****	****	****	****	****	****	****	SW	SW	SW	****	SW	SW	SSW	SSW	SSW	SW	SW	SW	SW	SW	SW	
5	WSW	WSW	SSW	SSW	SSW	SSW	SSW	SSW	S	SSE	SSE	SSE	SSE	SSE	SSE	S	S	S	SSW	V	V	V	N	N	
6	N	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	NE	NE	NNE	NE	NE	NE	NNE	NNE	
7	NNE	NE	NE	NNE	NE	NE	NE	NE	NE	NNW	WNW	WNW	C	W	W	SSW	WSW	SW	SSW	SSW	SSW	SSW	S	SW	
8	S	S	S	SW	SW	SW	W	W	WNW	NW	NW	NW	NW	NW	NW	WNW	WNW	WNW	NW	NW	NW	NW	NW	NW	
9	V	V	NW	NNW	V	NE	****	****	N	N	SW	SW	SW	SSW	SSE	V	V	V	V	V	V	NE	C	C	
10	C	C	SSE	SSE	SSE	C	SSE	S	SW	SW	SW	S	SSE	S	S	****	****	****	****	****	****	****	****	****	
11	****	****	****	****	****	****	****	****	****	****	****	****	****	NE	NE	NE	N	N	NNE	NE	NNE	V	ENE	ENE	
12	E	E	ENE	NE	NE	NE	NE	ENE	E	ESE	SE	ESE	SW	WSW	SW	W	WSW	SW	SSW	SW	SW	SW	SW	SW	
13	SW	SW	SW	SW	WSW	W	W	W	WSW	W	W	W	WNW	W	SW	SW	SW	SW	SW	WSW	WNW	WNW	WNW	NW	
14	NW	NNW	NW	****	SW	WSW	W	SW	W	W	WNW	****	****	V	V	V	V	V	V	C	SSW	SW	SW	SSW	
15	C	WSW	C	C	C	W	SW	W	WSW	SW	V	SSE	S	SSW	SSW	SE	E	ENE	ENE	ENE	ENE	V	SSE	SSE	
16	S	SW	SSW	SSW	S	SSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	W	NW	NW	NW	NW	NW	
17	WNW	W	W	W	WNW	NW	NW	NNW	N	N	N	N	NW	WNW	NW	NW	NW	WNW	NW	NW	NW	NW	WNW	W	
18	WNW	W	SW	WSW	W	W	W	W	W	WNW	WNW	WNW	W	W	SW	SW	SW	SW	SW	SW	W	WSW	SW	WSW	
19	WSW	SW	SW	SSW	SSW	SSW	SSW	SW	SW	SW	SW	****	****	****	SW	SW	SW	SW	SW	SW	WSW	WSW	V	WSW	
20	WSW	WSW	WNW	NNW	NNE	N	N	N	N	N	N	NE	NE	NNE	NNE	N	NE	NNE	NE	NE	C	C	C	C	
21	C	NW	N	N	C	C	C	C	SE	S	SSW	V	V	V	V	S	SSW	SSW	SSW	SSW	SSW	C	C	SSE	
22	C	SSE	SSE	SSE	SSE	S	S	SSW	W	SSW	SSW	SSW	SW	SW	SW	SW	SW	SSW	SW	SW	WSW	SW	SW	W	
23	SW	SSW	SW	WSW	W	WNW	W	WNW	WNW	WNW	WNW	W	W	SW	SW	SW	WSW	WSW	SW	SW	WSW	WSW	WSW	WSW	
24	SW	SW	SSW	WNW	WSW	NW	W	WNW	WNW	WNW	NW	WNW	NW	NW	NW	NW	NW	NW	NW	NNW	NW	WNW	WNW	W	
25	WSW	WSW	WSW	WSW	W	W	WNW	WNW	NW	NNW	NNW	NNW	NNW	NNW	NNW	N	NNW	WNW	WSW	SW	SW	WSW	WSW	WSW	
26	W	WNW	WSW	SW	SW	SSW	SSE	S	S	SSW	SSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	SW	SSW	SSW	
27	SSW	SSW	SSW	SW	SSW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	****	WSW	W	WNW	WNW	W	SW	SW	SW	SW	
28	SW	SW	WSW	C	C	C	E	C	C	SSW	WSW	WSW	WSW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	SW	SW	
29	W	NW	WNW	WNW	WSW	WSW	WSW	WSW	W	W	W	WNW	W	SW	SW	SW	SW	V	S	SW	WNW	WNW	WSW	WSW	
30	WNW	W	WNW	WNW	WSW	C	WNW	W	NNE	N	N	N	N	N	V	V	SW	SW	SW	SW	WSW	SW	C	C	

PERCENTAGE OF DATA VALID 85.1

**** - INSUFFICIENT DATA AVAILABLE

WIND VELOCITY AND DIRECTION DISTRIBUTION

DRECTION	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	V	C	NR
%FREQUENCY	4.6	1.8	3.8	1.1	0.7	0.3	0.4	2.9	3.1	7.1	20.0	7.6	7.1	6.7	6.1	1.9	4.0	6.0	14.9
AV. VELOCITY	9.3	7.9	7.7	5.8	6.0	3.5	3.0	4.3	5.9	7.7	14.1	7.9	8.6	8.8	14.8	8.3	5.3	0.5	

TABLE: F-2

OWMC AIR POLLUTION SURVEY

MET. DATA WIND DIRECTION-10m

UNITS PT. OF COMPASS

STATION LINCOLN COUNTY

MONTH JUL 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	C	C	C	C	C	C	C	E	SE	SE	SE	SE	SE	SE	SE	ESE	NNE	N	NNE	E	C	S	SSE	SSE	
2	SSE	ESE	****	N	N	N	N	N	N	N	N	N	N	N	N	NNW	NW	WNW	SW	SSW	SW	NNW	NW	WNW	
3	NW	NNW	NNW	N	N	N	N	NNW	NNW	NNW	N	NNW	NNW	NNW	NNW	NNW	NW	NNW	N	N	N	C	C	C	
4	C	C	C	C	C	WSW	C	SW	SW	SW	SW	SW	SW	SW	SW	WSW	SSW	SW	SW	SW	SW	SW	SW	SW	
5	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	SW	SW	SW	SW	SW	SW	
6	SW	SSW	SW	SSW	SSW	SW	S	S	SSW	SW	SW	SW	SSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	
7	SW	SW	SW	SW	SW	SW	SW	SW	SSW	SW	SW	SW	SSW	SSW	SSW	SSW	E	ENE	N	N	NW	WNW	NW	W	
8	WNW	W	SW	WSW	WSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	WSW	SW	WSW	SW	SW	SW	SW	
9	SW	C	WSW	WNW	NW	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	NW	WNW	
10	W	W	W	WNW	W	C	NW	N	NNE	NE	V	V	V	N	NE	V	WSW	SSW	N	SW	C	C	C	NNE	
11	N	NNE	NNE	NE	NE	NE	NNE	NE	NE	NE	NE	NNE	NNE	ENE	V	SW	S	SE	ESE	E	ENE	ENE	NE	ENE	
12	ENE	ENE	ENE	NE	NE	NE	NE	NNW	N	NW	N	N	N	NNE	NNE	NE	NE	NE	NE	NE	NE	ENE	ENE	ENE	
13	ENE	NE	NE	ENE	NE	E	SE	SSW	SW	WSW	SW	SW	SW	SW	SW	WSW	W	WSW	W	SW	SW	V	V	SW	
14	C	WSW	W	W	W	W	W	W	WNW	WNW	WNW	WNW	WNW	NW	WNW	NNW	N	N	WNW	WSW	WSW	WNW	WNW	W	
15	WSW	WSW	WNW	WSW	WSW	WSW	W	W	W	W	SW	SW	SW	WSW	SW	SW	SW	SW	SSW	SSW	SW	SSW	C	SSE	
16	C	C	S	WSW	ESE	SSE	S	ESE	S	SSW	SE	E	N	SW	SW	SSW	SW	SW	WSW	WSW	SW	S	S	C	
17	C	C	C	C	C	SE	C	C	SSW	SSW	V	V	S	S	SSW	SSW	SW	SW	SW	SSW	SSE	SSE	S	C	
18	V	****	W	W	V	V	SSW	S	S	SW	SW	WSW	SW	S	SSE	S	SSW	SW	SSW	V	N	V	V	V	
19	ENE	E	SSW	SW	WSW	WSW	SW	WSW	W	WNW	V	SW	SW	C	ENE	ESE	SSE	S	S	S	SSW	SSW	S	SSE	
20	SSE	SSW	SW	SSW	SW	C	V	WSW	WSW	WSW	W	W	WSW	V	N	N	N	NNW	N	N	V	N	NNW	V	
21	NNW	NNW	N	N	N	N	N	SW	SW	V	N	N	V	NE	V	V	V	V	V	NE	NE	NE	NE	C	
22	C	C	C	C	C	C	C	C	V	NE	ENE	V	V	V	V	SW	S	SSW	SSW	SSW	SSW	SSW	C	WSW	
23	WSW	C	C	C	C	C	C	C	SW	WSW	WSW	SW	V	V	SSW	S	SSW	SSW	S	S	C	C	C	C	
24	C	C	C	C	C	SE	SE	SE	SE	S	SW	SSW	S	SSW	SSW	SW	SW	SW	SSW	SSW	S	S	S	SSE	
25	S	S	SSE	S	SSE	SSE	S	SSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SSE	S	SSE	SE	SSE	S	
26	SSW	WSW	SW	SW	SW	SW	WSW	W	W	WNW	N	N	N	N	NW	N	N	N	N	NNE	N	NE	NE	N	
27	N	N	N	NNE	NE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	N	NNE	NNE	NE	NNE	ENE	ENE	NE	ENE	C	C	C	
28	C	C	C	C	C	C	C	C	S	SSW	SSW	SSW	WSW	SW	SSW	SSW	SSW	SSW	SW	SSW	S	S	S	SSW	
29	SW	WSW	WSW	WSW	W	NW	V	SW	WNW	NW	NW	WNW	WNW	W	SW	WSW	WNW	WNW	NW	NW	WNW	WNW	NW	NW	
30	NW	NW	NNW	NNW	NNW	N	N	N	N	N	N	N	N	N	NNE	N	N	N	NNE	NNE	NE	NNE	N	N	
31	N	V	NNE	C	NNE	C	C	C	NE	NE	NNE	N	W	V	C	SW	SW	SW	SW	SSW	C	C	C	SSW	

PERCENTAGE OF DATA VALID 99.7

**** - INSUFFICIENT DATA AVAILABLE

WIND VELOCITY AND DIRECTION DISTRIBUTION

DRECTION	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	V	C	NR
%FREQUENCY	12.8	4.0	5.0	2.6	0.9	0.8	2.2	2.4	5.2	7.8	20.8	5.9	3.9	3.5	2.8	3.0	5.1	11.0	0.3
AV. VELOCITY	7.9	5.9	6.2	6.1	4.1	5.3	5.7	4.8	6.2	7.7	11.8	7.1	9.0	11.0	9.8	11.4	6.2	0.4	

TABLE: F-3

OWMC AIR POLLUTION SURVEY

MET. DATA WIND DIRECTION-10m

UNITS PT. OF COMPASS

STATION LINCOLN COUNTY

MONTH AUG 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	SSW	S	S	SSW	SW	V	V	S	S	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	
2	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	
3	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	
4	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	
5	****	****	****	****	****	****	****	****	****	****	****	****	****	****	SW	SW	SW	SW	WSW	SW	SSW	S	SSW	SSW	
6	C	C	C	C	C	C	C	C	C	C	C	****	****	WNW	WNW	S	S	C	C	NE	NNE	NNE	NNE	NNE	
7	V	V	V	V	E	ESE	SE	SE	SE	SSE	SSE	ESE	SSE	SSW	SSW	SW	WSW	WSW	SW	C	C	C	C	C	
8	WSW	V	NNW	C	C	WSW	W	W	WSW	W	W	WSW	SW	SW	WSW	SW	SW	SW	SW	SW	SW	WSW	SW	SW	
9	SW	SW	SSW	SW	WSW	WSW	W	WSW	W	W	W	W	W	WNW	W	W	W	W	WSW	SW	SW	SSW	SSW	C	
10	C	C	C	C	C	C	SE	SSE	SE	SSE	SSE	SSE	SE	SE	SE	SE	V	SE	S	S	S	SW	WSW	W	
11	W	W	W	WNW	WSW	SW	WSW	W	W	W	W	WNW	WNW	WNW	WNW	WNW	WNW	WNW	NW	NW	W	W	W	W	
12	W	WSW	C	V	C	C	W	C	WNW	WNW	WNW	WNW	WNW	NW	V	V	WSW	WSW	SW	SW	SSW	C	C	C	
13	C	C	C	E	E	C	C	C	ENE	ENE	ENE	ENE	E	E	E	ESE	NE	NE	NE	NE	NE	ENE	ENE	E	
14	ESE	SE	SE	SE	SE	SE	SE	SE	SSE	S	S	S	S	S	S	SSW	SSW	SW	SSW	S	SSE	SSE	SSE	SSE	
15	S	SSW	SSW	SSW	SSW	SW	SSW	V	SSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	NW	V	E	SE	SSE	
16	SSW	SW	SW	SW	SW	WSW	WSW	WSW	WSW	W	W	W	WSW	SW	SW	SW	SW	SW	SW	SSW	S	SSE	SSE	S	
17	S	SW	WSW	C	C	C	C	C	WSW	SW	SSW	SSW	SW	W	WNW	NNE	N	N	NNE	C	C	C	C	WNW	
18	N	N	N	N	NNW	NNW	N	N	N	N	NNE	NNE	NNE	NNE	NNE	NNE	NE	NE	NE	NE	NNE	NE	NNE	N	
19	N	N	N	NNE	N	N	N	N	NNE	NE	NE	NNE	N	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NE	
20	NE	NE	NNE	NNE	NE	NNE	NNE	NNE	NE	NE	NE	NE	NE	NE	NE	NNE	NNE	NNE	N	N	NNE	NNE	C	C	
21	S	SSE	C	C	C	S	S	S	S	SSW	SSW	WSW	WSW	W	V	NNE	NNE	NNE	C	C	C	N	N	N	
22	N	N	NNE	NNE	NE	C	C	C	C	C	C	C	C	C	C	C	N	C	C	C	C	C	C	C	
23	C	C	C	C	C	C	C	C	C	S	SSW	SSW	SSW	SW	SW	SW	SW	SW	WSW	WNW	WNW	WNW	WNW	W	
24	W	W	W	W	W	W	W	W	W	WNW	NW	SW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NNW	WNW	
25	WNW	WNW	NW	WSW	WSW	C	W	WSW	WSW	WSW	SW	SW	SSW	SSW	SSW	SSW	SSW	SW	SW	SW	SW	SW	C	C	
26	C	C	C	SSE	SE	SSE	S	C	SSE	S	S	S	WNW	WNW	WNW	WNW	SW	SSW	SSW	S	****	****	****	****	
27	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	NW	NNW	N	N	
28	NNW	NW	NW	NW	NW	NNW	WNW	W	WNW	WNW	WNW	NW	WNW	WNW	NW	NW	NW	NW	WNW	WNW	W	W	W	W	
29	W	W	WSW	WSW	WSW	WSW	WSW	WSW	W	W	WNW	WNW	NW	V	V	WSW	SW	SW	SW	WSW	SW	WSW	WSW	C	
30	C	C	WSW	C	C	C	SW	C	WSW	SW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	SW	SW	WSW	C	C	C	C	
31	C	V	C	C	C	C	C	ENE	E	ESE	SE	E	ESE	ESE	SE	SE	SSE	N	NE	NE	NE	NE	NE	NE	

PERCENTAGE OF DATA VALID 82.9

**** - INSUFFICIENT DATA AVAILABLE

WIND VELOCITY AND DIRECTION DISTRIBUTION

DIRECTION	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	V	C	NR
%FREQUENCY	4.0	5.6	4.2	0.9	1.3	0.9	3.0	2.7	4.3	4.8	9.8	7.4	7.1	5.4	3.6	0.9	2.3	14.5	17.1
AV. VELOCITY	13.5	9.6	8.7	4.1	4.6	5.9	4.8	6.3	6.8	8.5	10.8	7.8	9.7	11.5	10.4	5.6	4.1	0.4	

TABLE: F-4 OWMC AIR POLLUTION SURVEY

MET. DATA WIND DIRECTION-10m UNITS PT. OF COMPASS

STATION LINCOLN COUNTY MONTH SEP 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	E	C	C	C	C	C	C	C	SE	S	SSW	SSW	ESE	SE	SSE	SSE	SSE	SSE	SSE	SSW	ESE	C	C	E	
2	SSE	C	C	C	C	C	C	C	C	SE	SE	SE	SE	SE	SE	SSE	E	ENE	NE	NNE	NE	ENE	ENE	ESE	
3	ESE	ESE	E	ENE	NE	NNE	C	C	NNE	SE	SE	SSE	SSE	SSE	ESE	NE	NNE	N	NE	SSE	SSE	S	S	SSE	
4	SSE	SSE	S	SSE	SSE	SSE	S	S	S	S	S	S	SSW	S	S	SSW	SSW	S	S	SSW	SSW	SSW	SSW	SSW	
5	SW	SW	SW	SW	SW	WSW	WSW	WSW	W	W	W	W	W	W	W	WSW	SW	WSW	WSW	WSW	WSW	SW	WSW	WNW	
6	WNW	****	****	****	****	****	****	W	W	WNW	W	WNW	W	W	W	W	W	WNW	WNW	WNW	SW	SE	ENE	N	
7	ENE	NW	C	C	W	WSW	W	W	WNW	WNW	WNW	WNW	W	W	W	WNW	WNW	WNW	WNW	WNW	W	W	W	WSW	
8	WSW	C	C	C	C	C	C	C	WSW	W	W	WSW	WSW	SW	SW	SW	****	SW	SW	SW	SW	SW	SW	SW	
9	SW	WSW	WSW	W	WSW	SW	C	C	WSW	W	WSW	WSW	SW	SW	SW	SW	SW	SW	WSW	C	C	SE	C	SE	
10	ESE	ESE	SE	SE	SE	SSE	S	S	SSW	SSW	SSW	SSW	WSW	SW	V	V	SSE	V	V	S	SSW	SSW	SSW	SSW	
11	SW	SW	SW	SW	SW	SSW	SW	SW	SSW	SW	SW	SW	SW	SSW	SW	SSW	SW	SW	SW	SSW	SSW	SSW	SSW	S	
12	V	SW	SW	SW	SW	SW	W	W	W	W	W	W	W	WSW	WSW	WSW	WSW	WSW	WSW	W	W	W	V	WSW	
13	WSW	WSW	W	C	C	WSW	WSW	WSW	WSW	WSW	WSW	WSW	W	W	W	W	WNW	WNW	WNW	NW	NW	NW	NNW	NNW	
14	NW	W	W	C	W	W	W	WNW	W	SW	WNW	W	WSW	W	WNW	WSW	SW	SW	SW	WSW	C	W	NNW	C	
15	N	N	NNE	N	C	C	N	C	C	C	V	E	E	V	NE	NE	NE	NE	NE	N	N	N	N	N	
16	N	N	N	V	WSW	WSW	WSW	NNW	N	N	N	N	N	N	N	N	N	N	N	NNE	N	N	N	N	
17	N	N	N	N	C	W	C	C	C	NE	ESE	SE	SE	SE	ENE	ESE	E	NE	NNE	NNE	NNE	NNE	NE	ENE	
18	ESE	SE	ESE	ESE	SSE	SSE	SSE	SSE	SE	SE	SE	SSE	SSE	SSE	S	S	S	SSE	SSE	****	C	C	C	C	
19	C	C	C	SSW	SW	NNE	N	N	****	NNE	N	NNE	N	NNE	NE	NE	NE	NE	NE	NE	NNE	NNE	NE	ENE	
20	ESE	E	ENE	ENE	ENE	ENE	E	C	NNW	N	NNW	N	N	N	N	N	NNE	NNE	NNE	NNE	NNE	NNE	NE	NE	
21	NE	NE	NE	NNE	NE	NNE	NE	NE	NE	NNE	NNE	NNE	NE	NE	NE	NE	NE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	
22	NNE	NE	NE	ENE	ENE	E	E	ESE	SE	ESE	SE	SSE	S	S	SSW	SW	SW	SW	SW	WSW	NW	NE	SSE	SW	
23	V	SSW	WSW	NNE	ESE	S	WSW	WSW	SW	SSW	SW	WSW	WSW	WSW	SW	WSW	W	W	W	WNW	WSW	WSW	WSW	WSW	
24	C	C	C	C	C	C	C	C	C	SSE	SW	SW	WSW	WSW	WSW	SW	SW	SW	SW	SSW	W	W	C	C	
25	C	C	C	C	C	C	C	C	NE	E	ENE	ESE	ENE	NNE	NNE	NE	NNE	NE	ESE	NE	NNE	NNE	NNE	NE	
26	C	C	C	SSE	NNW	NNE	W	N	WSW	SSW	SSW	SSW	SW	SW	SW	WNW	WNW	SW	SSW	W	N	ENE	N	N	
27	NNE	NE	NE	NE	ENE	ENE	NNE	NNE	NE	NE	NE	NE	NE	NE	NNE	N	N	NE	NNE	NNE	NNE	NNE	NNE	NNE	
28	NNE	N	N	N	NNW	NNW	NNW	C	C	C	S	SW	C	SW	SW	SW	WSW	WSW	C	WSW	SSE	SSE	SE	C	
29	SSE	SSE	S	S	S	SW	SSW	SSE	SSW	S	S	S	SSE	V	SSW	SSW	SW	SSW	SSE	SSE	SSE	S	SSW	SSW	
30	SSW	SSW	SSW	SSW	SW	SW	SW	SW	SW	SW	SW	SSW	SW	SW	SW	WSW	WSW	SSW	SSW	SSW	SW	SW	SW	NW	

PERCENTAGE OF DATA VALID 98.8 **** - INSUFFICIENT DATA AVAILABLE

WIND VELOCITY AND DIRECTION DISTRIBUTION

DRECTION	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	V	C	NR
XFREQUENCY	7.2	7.5	7.2	2.8	1.7	2.6	3.6	5.8	4.4	7.1	12.4	9.2	8.3	3.5	1.0	1.4	1.5	11.5	1.3
AV. VELOCITY	7.0	6.4	7.4	5.3	4.7	4.1	4.3	5.5	9.3	14.0	13.4	9.1	11.0	10.5	7.1	4.3	6.0	0.4	

TABLE: F-5

OWMC AIR POLLUTION SURVEY

MET. DATA WIND DIRECTION-10m

UNITS PT. OF COMPASS

STATION LINCOLN COUNTY

MONTH OCT 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	N	W	NNW	C	NNW	NNW	C	C	C	NNE	NE	V	C	C	C	V	NE	NE	NNE	NNE	NE	NE	NE	NNE	
2	N	NNE	N	N	NNE	NNE	NNE	N	N	N	N	N	N	NNW	V	V	V	SSW	S	SSW	C	C	C	C	
3	C	ESE	ESE	ESE	E	ESE	SE	SE	SE	SSE	SSE	S	S	SSE	SSE	ENE	SE	SSE	SSE	SSW	SSW	S	SSW	SSW	
4	SSW	NW	NNW	N	N	N	N	N	NE	NE	ENE	ENE	ENE	NE	NNE	NNE	NE	ENE	NNE	NNE	N	NNE	N	N	
5	N	N	N	N	N	NNW	NW	C	WSW	WSW	WSW	W	W	WSW	WSW	SW	SW	SW	WSW	SW	WSW	WSW	WNW	NW	
6	WNW	W	W	W	W	W	W	WNW	NW	NNW	NNW	NNW	NNW	WNW	WNW	NW	WNW	NW	WNW	WNW	WNW	N	C	SW	
7	S	ESE	C	C	C	WSW	WSW	SW	SW	WSW	WSW	WSW	WSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	
8	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	SW	SW	SW	SW	WSW	
9	SW	W	W	N	N	N	N	N	N	N	NNE	NNE	NNE	NNE	N	N	N	N	N	N	N	N	NNW	NNW	
10	NNE	N	N	NE	ENE	ENE	E	E	E	E	E	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	NE	ENE	ENE	E	E	
11	E	E	E	E	ESE	ESE	ENE	ESE	SSE	S	S	SSW	SSW	SSW	S	SSE	SSE	SE	ENE	NE	ENE	SSE	S	S	
12	S	S	S	S	S	S	SSE	S	S	S	S	S	S	S	SSE	SSE	SSE	SE	SE	SSE	S	SSW	S	S	
13	S	SSW	S	S	SE	SE	SE	SSE	SSE	SSE	SSW	WSW	WNW	W	WSW	WSW	WSW	WSW	S	SE	SE	C	E	E	
14	ESE	ESE	SE	SSE	SSW	SSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	W	W	WSW	WSW	W	W	W	WSW	
15	W	WSW	WSW	W	W	WSW	WSW	WSW	WSW	W	W	W	W	W	W	WSW	W	W	WSW	W	WNW	NW	WNW	NNW	
16	WNW	SW	C	S	SSW	WSW	SW	SW	SW	WSW	WSW	WSW	WNW	W	SW	WSW	W	WNW	NNW	NNE	C	C	C	ESE	
17	ENE	ENE	NNE	N	NNE	NE	NE	NE	NE	NE	NE	NE	NNE	NE	NE	NE	NE	NE	NNE	N	N	N	N	V	
18	N	N	NW	V	C	N	NNW	NNW	NNW	N	N	N	NNE	NNE	V	V	V	NE	SE	S	C	C	C	C	
19	C	C	C	C	C	C	C	WSW	W	W	W	WNW	NW	WSW	W	W	SW	SW	SW	WSW	WSW	WSW	WSW	WSW	
20	W	W	W	SW	C	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	SW	SW	SW	SW	SW	SW	SW	WSW	WSW	WSW	WSW	
21	WSW	WSW	WSW	SW	SW	SW	SW	SW	SW	WSW	WSW	WSW	WNW	W	W	W	WSW	SSW	SSW	SW	C	SW	SSW	C	
22	C	C	SW	SW	SSW	C	SW	S	SSE	SSE	SSE	SSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	SW	
23	SW	WSW	SW	SW	SW	SW	WSW	WSW	WSW	WSW	W	W	WNW	W	W	N	N	NNW	NW	N	N	N	N	N	
24	N	N	N	NNW	N	C	V	NE	NE	ENE	NE	NE	NE	NE	NE	NNE	NNE	NNE	NNE	NE	NE	NE	ENE	NE	
25	ENE	ENE	ENE	NE	NE	ENE	E	NE	NE	NE	NE	NE	NE	NNE	NNE	NE	NE	NNE	NNE	NNE	NE	NE	NE	E	
26	E	ESE	ESE	SE	E	E	ENE	ENE	NE	ENE	ENE	NE	NE	ENE	NNE	NNE	NNE	NE	NNE	N	NNE	NNE	NNE	C	
27	C	C	C	C	C	SW	C	SSE	S	SSW	SSW	SSW	SW	SW	SW	SW	SW	SW	WSW	WSW	W	WNW	WSW	W	
28	WNW	W	W	W	WNW	W	W	C	W	W	WSW	WSW	WSW	WSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	
29	WSW	WSW	WSW	SW	SW	SW	SW	SW	WSW	WSW	WSW	WSW	SW	SW	WSW	WSW	WSW	W	WNW	WNW	WNW	NW	W	NNW	
30	WNW	WNW	WNW	WNW	W	WNW	N	N	N	N	N	NNE	NNE	NE	NNE	NNE	NNE	NE	C	C	NE	C	C	C	
31	NE	ENE	ENE	E	E	ESE	E	ESE	ESE	SE	SE	SE	SSE	SSE	SSE	SSE	ESE	SE	SSE	S	SSW	SSW	SSW	SSW	

PERCENTAGE OF DATA VALID 100.0

**** - INSUFFICIENT DATA AVAILABLE

WIND VELOCITY AND DIRECTION DISTRIBUTION

DRECTION	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	V	C	NR
%FREQUENCY	9.3	6.2	7.8	4.7	3.0	2.3	2.6	3.8	4.7	3.8	14.4	13.0	7.8	3.9	1.5	2.7	1.5	7.3	0.0
AV. VELOCITY	7.5	8.3	7.3	8.2	6.3	4.2	6.0	8.4	7.8	9.0	13.6	11.5	12.4	11.3	9.5	7.6	3.1	0.5	

TABLE: F-6 OWMC AIR POLLUTION SURVEY

MET. DATA WIND DIRECTION-10m UNITS PT. OF COMPASS

STATION LINCOLN COUNTY MONTH NOV 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	SSW	SSW	SSW	SSW	SSW	SSW	SW	SSW	SW	SW	SW	SW	SW	SW	SW	SW	W	N	N	N	N	N	N	V	
2	NW	NW	NNW	N	C	WSW	W	NNW	NNW	NW	WNW	WNW	NW	W	W	WNW	WNW	WNW	WNW	WNW	WNW	NW	C	C	
3	V	C	C	C	SE	SE	V	V	C	C	S	SSW	SW	SW	SW	SW	SW	SW	SW	WSW	WSW	W	W	W	
4	W	W	W	W	NW	NNW	NW	WNW	NNW	NNW	N	N	NNE	NE	NE	NE	NE	NNE	NNE	NNE	NNE	NNE	NE	ENE	
5	ENE	NE	NE	NE	ENE	ENE	ENE	ENE	ENE	E	E	ESE	E	ESE	E	E	E	SE	SSE	SE	ESE	C	SE	C	
6	C	C	C	C	C	C	C	C	WSW	WSW	WSW	W	W	WSW	SW	SW	SW	SW	S	C	C	C	SE	SE	
7	ESE	ESE	SE	SE	SE	ESE	ESE	ESE	ESE	ESE	SE	C	E	NE	NE	ENE	ENE	NNE	NNE	NNE	NNE	C	NNE	C	
8	NNE	NNE	NE	NE	ENE	E	ESE	ESE	SE	SSE	SSE	SSE	S	SSW	SW	SW	SW	SW	SW	SW	WSW	WSW	WSW	WSW	
9	W	W	SSW	SSW	SW	SW	SW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WNW	WNW	W	WNW	W	W	W	
10	W	W	WSW	WSW	WSW	WSW	WSW	WSW	WSW	W	W	W	W	W	W	W	SW	SSW	SSW	C	ESE	ENE	ESE	C	
11	ESE	E	C	V	WNW	C	C	SE	ESE	C	NNE	C	C	W	WNW	WNW	W	WNW	WNW	W	W	W	NW	NW	
12	WSW	C	S	S	WSW	W	SW	SW	WSW	SW	SW	WSW	V	W	WSW	WSW	WSW	W	W	W	W	W	WNW	WNW	
13	WNW	WNW	W	WNW	WNW	W	W	W	WNW	NNW	NNW	WNW	W	WNW	W	W	WNW	W	W	W	W	W	W	W	
14	WSW	W	WSW	WSW	W	W	W	W	WNW	WSW	SW	WSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	
15	SW	SW	WSW	WSW	W	W	WSW	W	W	WSW	SW	WSW	WSW	SW	SW	SW	SW	SW	SW	SW	WSW	W	W	WSW	
16	WSW	SW	WSW	WSW	V	V	V	SW	SW	S	S	S	SSE	ESE	C	C	C	C	C	SW	WSW	W	W	WSW	
17	W	W	WSW	SSW	C	SSW	SSW	SW	WSW	WSW	SW	SW	SW	SW	SW	WSW	WSW	W	WNW	WNW	W	W	V	V	
18	W	W	V	V	V	N	NNE	NNE	NE	NE	NE	NE	ENE	ENE	NE	NE	NE	NE	NE	NE	NNE	N	N	N	
19	N	N	N	N	N	N	N	N	N	NNE	NNE	NNE	NE	NE	NE	NE	NNE	NE	NE	NE	ENE	E	E	E	
20	E	E	E	E	E	E	E	ENE	ENE	E	ESE	E	E	E	E	E	E	ENE	ENE	NE	NNE	NNE	NNW	N	
21	N	N	N	NNW	NNW	NNW	NNW	NNW	NW	NW	NNW	NNW	NW	NW	NW	WNW	NW	N	N	W	W	WNW	W	WSW	
22	WSW	WSW	W	V	C	C	C	C	C	SE	SE	SSE	SSE	SW	SW	SW	S	SSE	SSE	S	S	SSE	SE	SE	
23	ESE	E	E	ESE	SSE	S	S	S	S	S	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SW	SW	SW	SW	S	SW	
24	WSW	WSW	W	W	WSW	WSW	WSW	WSW	W	W	W	WSW	WSW	W	W	W	W	W	W	WSW	WSW	W	WSW	WSW	
25	WSW	WSW	WSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SSW	SW	SSW	SSW	S	SSE	SSE	SE	ESE	NE	NE	
26	NE	NE	NE	NE	E	ESE	NE	NE	NNE	NNE	NNE	NNE	NNE	N	NNE	NNE	NNE	N	N	N	N	WNW	W	WNW	
27	WNW	WNW	W	WNW	WNW	NW	W	WSW	W	W	WSW	SW	SW	SW	WSW	WSW	SW	SW	SW	SW	SW	SW	SW	SW	
28	WSW	WSW	WSW	W	WSW	WSW	WSW	WSW	WSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	WSW	WSW	WSW	
29	WSW	WSW	WSW	WSW	W	W	WSW	W	WSW	W	WSW	W	WNW	WNW	WNW	NW	NW	W	W	W	N	N	N	NNE	
30	NNE	N	N	NNE	NNE	N	N	N	N	NNE	NNE	NE	NE	NE	NE	NE	NE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	

PERCENTAGE OF DATA VALID 100.0 **** - INSUFFICIENT DATA AVAILABLE

WIND VELOCITY AND DIRECTION DISTRIBUTION

DRECTION	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	V	C	NR
%FREQUENCY	5.8	5.1	6.1	3.5	4.0	3.1	2.5	1.8	2.5	3.8	15.0	13.8	14.4	5.7	2.5	2.2	2.1	6.1	0.0
AV. VELOCITY	10.0	8.4	10.2	9.0	8.8	4.9	4.8	6.4	6.8	11.9	16.3	13.0	12.1	12.1	9.3	10.6	3.1	0.7	

TABLE: F-7

OWMC AIR POLLUTION SURVEY

MET. DATA WIND DIRECTION-10m

UNITS PT. OF COMPASS

STATION LINCOLN COUNTY

MONTH DEC 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	ENE	ENE	ENE	ENE	ENE	ENE	E	E	ENE	ENE	ENE	E	E	ENE	ENE	ENE	ENE	ENE	ENE	E	E	E	E	E	
2	E	E	ESE	ESE	ESE	E	E	ESE	E	E	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	E	E	ENE	ENE	
3	E	E	ESE	C	C	SSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	SW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	
4	WSW	WSW	WSW	WSW	WSW	WSW	WSW	W	W	WSW	WSW	WSW	WSW	W	W	WNW	W	W	W	W	W	W	W	W	
5	W	W	W	WSW	WSW	WSW	WSW	WSW	WSW	W	W	W	WSW	WSW	WSW	WSW	WSW	WSW	W	WSW	WSW	WSW	WSW	SW	
6	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	W	WNW	W	WNW	W	C	
7	C	C	C	C	E	ESE	SE	S	SW	SW	SW	SW	SW	SW	WSW	WSW	WSW	WSW	WSW	W	W	WSW	WSW	W	
8	W	W	NW	N	N	NNE	NNE	NE	NE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	NE	
9	NE	NE	NE	NNE	NNE	NNE	NNE	NE	V	V	V	NNE	NNE	NNE	NNE	NNE	N	NW	WSW	WSW	WSW	WSW	W	W	
10	WSW	WSW	WSW	WSW	WSW	WSW	WSW	W	W	W	W	W	W	W	W	W	WSW	WSW	W	WSW	W	W	W	W	
11	W	W	W	W	WSW	WSW	WSW	SSW	SSE	SSW	SSW	SSW	SSW	SW	SSW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	
12	WSW	WSW	WSW	WSW	WSW	W	W	W	W	W	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	W	W	W	W	W	WNW	
13	WNW	N	N	N	WNW	WNW	WNW	WNW	W	NW	WNW	NW	NW	WNW	W	W	WSW	WSW	S	S	SW	SSW	SW	WSW	
14	SW	SW	SW	SW	SW	SW	SW	SW	SW	SSW	SSW	SW	SW	SW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	
15	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	SW	SW	SW	SW	SW	WSW	C	SW	WSW	
16	W	W	W	W	W	WSW	W	WNW	C	V	C	C	C	V	ESE	ENE	NE	NNE	NE	NE	NE	NE	ENE	E	
17	C	C	NNE	ENE	ENE	ENE	E	ESE	SE	SE	SE	SSE	SSE	SSE	SSE	SE	SE	SSE	ESE	ESE	E	ESE	ESE	E	
18	ESE	ESE	ESE	ESE	SE	SE	SSE	S	SSW	SW	WSW	WSW	WSW	WSW	SW	SW	SW	SW	WSW	WSW	W	WNW	WNW	WNW	
19	WNW	WSW	WSW	W	WSW	WSW	W	W	W	WSW	W	W	W	WSW	WSW	WSW	WSW	WSW	W	W	W	W	W	W	
20	W	W	W	W	WSW	WSW	SW	WSW	SW	SW	WSW	W	W	WNW	W	WNW	WNW	NNW	NW	WNW	NW	WNW	NW	N	
21	NW	NW	NW	NNW	NW	NW	NW	NW	NW	NW	NW	V	V	V	WSW	W	W	WSW	WSW	SW	SW	WSW	SW	WSW	
22	WSW	WSW	WSW	WSW	WSW	WSW	SW	SW	SW	WSW	WSW	WSW	WSW	WSW	SW	SW	SW	SW	SW	SW	WSW	SW	SW	SW	
23	SW	SW	WSW	WSW	WSW	WSW	W	W	W	WSW	WSW	SW	SW	SW	SW	SW	SW	WSW	WSW	SW	SSW	V	C	ENE	
24	E	E	E	ENE	E	E	ENE	ENE	ENE	ENE	E	ENE	ENE	ENE	ENE	ENE	ENE	NE	NE	NE	NE	V	V	NE	
25	ENE	ENE	ENE	ENE	ENE	C	V	WSW	WSW	WSW	WSW	W	W	W	W	W	W	WSW	WSW	WSW	WSW	WSW	WSW	WSW	
26	WSW	WSW	SW	SW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	W	W	W	W	W	WSW	WSW	W	C	W	W	W	WSW	
27	WSW	WSW	SW	C	V	V	W	W	V	C	V	C	C	SSW	SSW	SSW	SSW	SSW	C	SSW	SW	C	V	SW	
28	SW	W	V	WSW	WSW	WSW	W	W	SW	SW	SW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	SW	WSW	
29	SW	SW	SW	SSW	SW	SSW	SSW	SSW	SSW	SSW	SSW	SW	SSW	SW	SSW	SSW	S	C	C	V	NE	NE	NNE	NNE	
30	NNE	NE	C	C	W	E	NNE	NNE	NE	NNE	NNE	NNE	N	N	NNE	NNE	NNE	NNE	NNW	NNW	NW	NNW	NW	NNW	
31	NW	NW	WNW	W	SW	V	V	WSW	WSW	WSW	SSW	SSE	S	S	SSE	SSE	SE	ESE	ESE	S	SSE	S	S	S	

PERCENTAGE OF DATA VALID 100.0

**** - INSUFFICIENT DATA AVAILABLE

WIND VELOCITY AND DIRECTION DISTRIBUTION

DRECTION	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	V	C	NR
%FREQUENCY	1.2	3.4	2.8	8.5	4.2	2.4	1.2	1.5	1.5	3.9	13.0	26.9	15.3	4.0	3.0	0.8	2.8	3.6	0.0
AV. VELOCITY	9.0	5.9	9.0	13.6	11.3	6.8	5.3	5.4	4.8	9.2	15.4	15.1	14.6	10.4	6.0	5.8	3.8	0.7	

TABLE: F-8 OWMC AIR POLLUTION SURVEY

MET. DATA WIND DIRECTION-10m UNITS PT. OF COMPASS

STATION LINCOLN COUNTY MONTH JAN 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	SSE	SSE	SE	ESE	E	E	E	ENE	E	ESE	ESE	SE	E	ENE	E	NNE	NNE	NE	NE	NE	NE	NNE	NE	NNE	
2	****	****	****	****	****	****	****	****	NE	NE	NNE	NNE	NNE	NNE	N	N	NNW	NNW	N	N	N	NNW	NW	WNW	
3	WNW	W	W	W	NW	WNW	WNW	W	W	W	W	WSW	WSW	W	WSW	WSW	W	W	WSW	W	W	WSW	SW	V	
4	V	W	W	V	WSW	W	WNW	V	C	NW	WSW	SSE	SSE	V	WSW	WNW	WNW	C	W	WSW	WSW	V	C	WSW	
5	C	WSW	W	WSW	SSE	C	WSW	SW	WSW	WSW	V	V	WSW	WSW	SW	SSW	S	SSW	V	C	C	SE	SE	ESE	
6	ESE	ESE	SE	ESE	SE	SE	SE	SE	SE	SSE	SSE	SSE	S	SSE	SSE	SSE	SE	SSE	S	SSW	SSW	SW	SW	SW	
7	SW	SW	WSW	WSW	WSW	WSW	WSW	W	W	W	WNW	WNW	WNW	WNW	WNW	NNW	NW	NW	NW	NW	NNW	WNW	NW	NW	
8	NW	NNW	NW	NNW	NNW	NNW	NW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	W	W	W	WSW	W	W	W	
9	W	W	W	W	WSW	WSW	WSW	WSW	WSW	WSW	W	WSW	SW	SW	SW	SW	SSW	SE	ESE	E	E	E	E	E	
10	E	ENE	E	E	E	ESE	E	E	ENE	ENE	ENE	E	E	SE	S	SW	SW	SW	WSW	WSW	W	WSW	W	W	
11	WNW	WNW	W	WNW	NW	NNW	NNW	NNW	NW	NW	NW	WNW	WNW	WNW	WNW	W	WSW	NNW	NNW	NNW	WSW	WSW	WSW	WSW	
12	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	W	W	W	WNW	NW	WNW	WNW	WNW	WNW	NW	WNW	WNW	WNW	
13	WNW	WSW	W	WNW	WNW	WNW	W	W	WSW	W	W	W	W	WSW	WSW	WSW	SW	SW	SSW	SSW	SSW	S3W	S	S	
14	SSW	SSW	SSW	SSW	SSW	SW	SW	WSW	WSW	WSW	WSW	WSW	SW	SW	SW	SW	SW	WSW	WSW	WSW	WSW	SW	SW	SW	
15	SW	SW	SW	SW	SW	SW	WSW	WSW	SW	WSW	WSW	WSW	W	W	WNW	W	W	W	W	WNW	WNW	NW	WNW	NW	
16	NW	WNW	WNW	NW	WNW	WNW	WNW	WNW	N	NNE	NNE	NE	V	V	E	SE	SE	SSE	C	W	NW	NW	WNW	WNW	
17	N	NNE	ENE	E	ENE	ENE	ENE	E	ESE	ESE	ESE	E	E	E	ENE	E	ENE	ENE	E	E	E	E	E	E	
18	E	ENE	E	SE	V	V	V	S	S	SSW	SSW	SW	W	W	W	W	W	WNW	NW	NW	W	W	V	V	
19	SW	W	NW	C	N	N	N	NE	NE	NE	ENE	ENE	NE	NE	NE	NE	ENE	NE	NE	NNE	NE	NNE	NNE	N	
20	N	NNW	NNW	NW	NW	NW	W	SW	W	WSW	W	WSW	WSW	WSW	SW	SW	WSW	SW	SW	SW	SW	SW	SW	WSW	
21	W	W	WSW	WSW	WSW	WSW	WSW	WSW	W	WSW	WSW	WSW	WSW	WSW	WSW	SW	SW	WSW	SW	SW	SW	SSW	SSW	SSW	
22	S	S	S	SSE	SE	SE	SE	SE	SE	SSE	SSE	S	S	SSW	S	S	SSE	ESE	ESE	ESE	E	C	C	C	
23	WSW	W	W	W	W	WNW	WNW	WNW	W	WNW	W	W	W	W	W	W	W	WSW	WSW	V	N	W	WSW	WSW	
24	W	W	W	WSW	W	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	
25	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	W	WNW	W	SW	C	C	C	SSE	NW	NNW	N	
26	N	N	N	NW	NNE	NNE	NNE	N	N	N	N	NNE	NNE	NNE	NE	NE	NNE	NNE	C	W	C	WSW	C	W	
27	C	C	C	C	C	C	C	C	C	C	WSW	WSW	W	WSW	WSW	WSW	WSW	WSW	SW	SW	SW	SW	SSW	WSW	
28	SW	SSW	SW	SSW	SSW	S	SSW	SW	WSW	SW	WSW	W	W	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	W	W	
29	W	W	W	W	W	W	W	WNW	WNW	NW	N	ENE	ENE	ENE	ENE	ESE	E	NE	ENE	ENE	ENE	ENE	E	ENE	
30	ENE	E	E	ESE	ESE	ESE	SE	SSE	S	SSW	SW	SSW	SSW	SSW	SSW	SSW	SW	WSW	WSW	WSW	WSW	W	W	W	
31	W	WNW	WNW	WNW	WNW	WNW	WNW	NW	NW	NW	NW	NW	NW	NW	NW	WNW	WNW	WNW	WNW	W	W	W	V	SW	

PERCENTAGE OF DATA VALID 98.9 **** - INSUFFICIENT DATA AVAILABLE

WIND VELOCITY AND DIRECTION DISTRIBUTION

DRECTION	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	V	C	NR
XFREQUENCY	3.0	3.0	2.8	3.6	5.2	2.6	3.0	2.6	2.3	4.2	8.3	21.6	14.4	8.3	5.5	2.4	2.4	3.8	1.1
AV. VELOCITY	8.0	9.7	15.0	10.3	8.6	6.6	6.0	5.2	7.9	11.5	12.8	15.3	14.0	13.5	12.4	11.4	4.4	0.6	

TABLE: F-9

OWMC AIR POLLUTION SURVEY

MET. DATA WIND DIRECTION-10m

UNITS PT. OF COMPASS

STATION LINCOLN COUNTY

MONTH FEB 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	WSW	SW	SE	C	SE	SE	SE	SSE	SSE	S	S	S	S	SSW	SW	SW	SW	SW	SW	SW	WSW	SW	SW	SW	
2	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	SW	SW	WSW	SW	SW	SSW	SSW	SSW	SSW	SSW	S	S	SSE	
3	SE	ESE	V	SSE	WSW	WSW	SW	WSW	WSW	WSW	W	W	NW	NW	WNW	WNW	WNW	WNW	WNW	NW	W	W	WNW	W	
4	WSW	WSW	WSW	W	W	W	W	W	WSW	W	WSW	SW	WSW	W	W	W	WNW	NW	WNW	WNW	WNW	WNW	W	W	
5	W	W	W	WSW	C	C	C	V	WSW	SW	C	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SW	SW	
6	SSW	SSW	SW	SW	WSW	WSW	SW	SW	WSW	WSW	SSW	S	SSE	SSW	SSW	SSW	SW	SW	SW	WSW	WSW	WSW	WSW	WSW	
7	WSW	W	W	WSW	WSW	W	WSW	WSW	W	W	WNW	W	WSW	WSW	WSW	WSW	SW	SW	SSW	SSW	SSW	SSW	SSW	S	
8	S	S	S	S	S	SSW	SSW	SSW	SW	SW	SW	WSW	WSW	WSW	SW	V	N	N	N	N	N	N	N	N	
9	N	N	N	N	N	N	N	N	N	N	N	N	V	WSW	WSW	SSW	SSW	SSW	SSW	SSW	SW	SSW	SW	SW	
10	SW	SW	SW	SW	SW	SW	SW	WSW	WSW	WSW	WSW	WSW	WSW	W	WSW	W	W	W	SSW	SSW	WSW	WSW	W	WSW	
11	W	WSW	WSW	WSW	WSW	SW	WSW	WSW	W	W	WSW	C	C	C	C	C	ESE	SSE	C	ESE	ESE	SE	ESE	ESE	
12	E	E	ENE	ENE	NE	NE	NE	NE	NNE	NNE	NNE	NNE	NNE	NNE	NE	N	WSW	S	SSW	SW	W	WNW	N	N	
13	N	N	NW	WNW	NW	NNW	SW	W	N	N	N	N	N	V	V	C	V	ESE	V	ENE	E	C	E	C	
14	NE	NE	ENE	NE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	NE	ENE	NE	NE	NE	NE	NE	NNE	NNE	N	N	N	N	
15	N	N	N	N	N	N	N	N	N	N	N	N	N	NNW	WSW	WSW	WSW	C	C	C	C	N	NNE	NNE	
16	NNE	NE	NE	NE	ENE	E	SE	ENE	NE	ENE	NE	NE	NE	NE	NE	NE	NE	NNE	NNE	NE	NE	NE	ENE	ENE	
17	NE	NE	ENE	ENE	NE	NE	ENE	ENE	ENE	ENE	NE	NE	NE	NE	NE	NE	NNE	NNE	NE	NE	NE	ENE	C	C	
18	C	C	C	NNE	NNE	NE	NE	NE	NNE	NE	NNE	NNE	NNE	N	N	N	N	N	C	C	WNW	NNW	N	SW	
19	SW	NW	S	SSW	SSW	S	SSW	SSW	C	S	S	SSW	SSW	SW	SSW	SW	SW	SW	SW	SW	SW	WSW	WSW	WSW	
20	W	C	W	N	N	V	C	V	C	C	C	V	V	V	V	V	S	SSE	C	SSE	C	C	SSE	SSE	
21	C	C	C	C	C	C	C	C	C	E	C	C	C	C	C	C	C	NNE	NNE	NNE	NE	NE	NE	NE	
22	ESE	C	NE	ENE	ENE	ENE	C	ENE	NE	C	C	V	E	ENE	ENE	C	C	N	N	NNE	N	N	NNE	NNE	
23	N	NNE	N	NNE	N	N	N	N	W	WNW	WNW	WNW	WSW	SW	SSW	SSW	S	SSW	SSW	SSW	SW	SW	SW	SSW	
24	SSW	SW	SSW	SW	SW	SW	SW	SW	WSW	N	WNW	N	N	V	V	V	SW	SW	WSW	W	WSW	W	W	W	
25	WNW	SW	V	SW	WSW	W	C	SW	SW	WSW	WSW	SSW	WNW	WNW	W	W	WNW	WSW	SSW	C	V	V	V	V	
26	NNE	NNE	W	WSW	SW	V	C	V	N	N	N	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NE	NNE	NE	NE	
27	ENE	ENE	NE	NE	NNE	NNE	NE	NE	ENE	NE	ENE	ENE	NE	NE	NE	NE	NE	NNE	NNE	NNE	NE	NE	ENE	ENE	
28	ENE	ENE	E	ESE	ESE	SE	ESE	C	ENE	NE	NE	E	E	ENE	NE	NE	NE	ENE	NE	ENE	ENE	ENE	****	****	

PERCENTAGE OF DATA VALID 99.7

**** - INSUFFICIENT DATA AVAILABLE

WIND VELOCITY AND DIRECTION DISTRIBUTION

DRECTION	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	V	C	NR
XFREQUENCY	10.7	6.8	10.7	6.7	1.5	1.6	1.2	1.5	3.0	8.5	12.1	10.9	6.8	3.4	1.0	0.4	3.9	8.9	0.3
AV. VELOCITY	13.1	8.6	10.4	8.4	4.5	4.0	5.3	5.7	10.4	11.8	12.8	10.1	10.5	13.0	14.7	6.3	4.4	0.6	

TABLE: F-10 OWMC AIR POLLUTION SURVEY

MET. DATA WIND DIRECTION-10m UNITS PT. OF COMPASS

STATION LINCOLN COUNTY MONTH MAR 1987

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	NE	NE	NE	NE	NE	NNE	NNE	NNE	NNE	NE	C	C	C	C	C	SSW	SSW	SW	SW	SW	SW	SW	SW	SW	
2	SW	SW	SW	SW	SW	SW	WSW	W	W	W	W	W	W	W	WSW	WSW	WSW	WSW	WSW	WSW	W	W	W	WSW	
3	WSW	SW	SSW	SW	SW	WSW	W	W	W	W	W	W	WSW	WSW	W	W	W	W	WNW	WNW	W	W	W	WNW	
4	WNW	WNW	WNW	N	W	WNW	W	SW	SW	SW	W	W	W	WSW	SW	WSW	WSW	SW	SW	WSW	SW	WSW	WSW	SW	
5	W	C	NE	C	C	ENE	ESE	SE	C	SE	SSE	S	SE	SE	ENE	ENE	E	V	NNE	NNE	NE	C	C	C	
6	V	C	C	C	V	V	SE	SSE	SSE	S	S	SSW	SSW	SSW	SW	SW	SW	SSW	SSE	SSE	S	S	S	SSW	
7	SSW	SSW	SSW	S	S	S	S	S	SSW	SW	SSW	S	S	SSW	SSW	SSW	SSW	SSW	SW	SW	SSW	SSW	SW	SW	
8	V	V	V	S	C	V	V	SSE	S	S	SSW	SSW	SSW	SSW	SSW	SSW	SSW	S	S	SSE	V	V	N	N	
9	N	N	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NE	NE	NNE	NE	NE	NE	NNE	NNE	NNE	NNE	****	
10	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	
11	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	
12	NNE	NNE	N	N	N	WNW	W	WNW	V	V	V	V	V	S	SSW	SSW	SW	SW	SW	SW	SW	SW	SW	SW	
13	SW	SW	SW	SW	WSW	SW	SW	SSW	SSE	SE	SE	SSW	SSW	SSW	S	SW	SSW	SSW	S	W	N	C	WNW	V	
14	SSW	C	C	E	C	ENE	ENE	ENE	ENE	ENE	E	E	V	E	ESE	V	NNE	NNE	NNE	NNE	NNE	NNE	NE	NNE	
15	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NE	NE	NE	NE	NE	NNE	NNE	NNE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
16	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NE	NE	NNE	NNE	NNE	NNE	NE	NE	NNE	N	W	WNW	W	W	WSW	WSW	W	
17	N	N	N	N	N	N	N	N	NNW	NNW	NNW	N	NW	N	N	N	N	N	N	N	N	WNW	WSW	V	
18	WSW	WSW	V	V	N	W	NW	N	NNE	NE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NE	C	NE	NE	V	
19	V	V	V	N	NNE	N	N	NNE	NE	NNE	NE	E	NNE	N	N	N	NNE	NNE	V	WSW	WSW	W	WSW	NNW	
20	NNE	WSW	SW	WSW	WSW	W	W	SSW	NNW	N	N	NNE	WNW	WNW	NW	N	NE	NE	NE	NE	ENE	ENE	NE	NNE	
21	NNE	N	N	N	NW	NW	WSW	WNW	NW	N	N	N	NNW	N	N	N	N	N	NNW	NNW	NNW	WNW	WSW	W	
22	WNW	W	WNW	W	N	NNW	NW	V	NNE	NNE	NE	NE	NNE	NNE	NE	NE	NE	NE	NE	NNE	NNE	N	N	N	
23	N	NNE	V	V	V	C	C	NE	ENE	E	E	E	V	NNE	NNE	NNE	NE	NNE	NNE	NNE	NE	NE	E	ENE	
24	ENE	ENE	ENE	NE	NE	NE	ENE	E	ESE	SE	SE	ESE	V	NNE	NE	NE	NNE	N	N	NNE	ENE	ESE	ESE	SE	
25	ESE	ESE	ESE	SE	S	S	SE	ESE	SE	SSW	SSW	SE	SE	SE	ESE	SE	SE	SE	SSE	S	SSW	SSE	S	SSW	
26	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SW	SSW	
27	SW	SSW	SW	SW	SE	SE	SE	SE	S	SSW	SSW	S	SSW	SSW	SW	SW	SW	C	NE	NE	NE	NE	NE	NE	
28	NE	NNE	NNE	NNE	NNE	N	N	N	NNE	NE	NE	NE	NE	NE	NNE	NNE	NNE	NE	NNE	N	NNE	V	NNE	E	
29	V	V	C	C	NE	NNE	NE	NE	E	ESE	V	V	NE	NNE	NNE	NNE	NE	NE	E	ESE	SE	V	S	SSW	
30	SW	SSW	SW	SSW	SSW	SSW	SSW	SW	SW	SW	SW	WNW	WNW	NW	N	N	N	N	N	N	N	NNW	NNW	NNW	
31	NNW	N	N	NNW	NNW	NW	NNW	NNW	NW	NW	NW	WNW	WNW	W	W	W	W	W	W	W	WSW	WSW	WSW	WSW	

PERCENTAGE OF DATA VALID 94.5 **** - INSUFFICIENT DATA AVAILABLE

WIND VELOCITY AND DIRECTION DISTRIBUTION

DRECTION	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	V	C	NR
%FREQUENCY	9.3	15.1	10.5	2.3	1.9	1.7	3.2	1.3	3.8	10.1	8.2	4.8	6.6	3.0	1.6	2.4	5.2	3.5	5.5
AV. VELOCITY	10.6	11.7	12.1	5.5	6.0	7.8	8.2	8.2	10.2	14.5	12.5	12.2	14.2	9.6	10.9	12.2	5.1	0.8	

TABLE: F-11

OWMC AIR POLLUTION SURVEY

MET. DATA WIND DIRECTION-10m

UNITS PT. OF COMPASS

STATION LINCOLN COUNTY

MONTH APR 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	WSW	WSW	WSW	WSW	C	C	WSW	SW	SSE	SE	S	SSW	S	S	SSE	S	S	S	SSE	SSE	SE	SE	SE	SSE	
2	S	S	S	SSW	SW	SW	SSW	SW	SW	SW	SW	SW	SW	SW	SSW	SW	SW	SW	SW	SW	WSW	WSW	W	WSW	
3	WSW	WSW	SW	SW	WSW	WSW	W	W	W	W	W	WSW	WSW	NE	WNW	V	V	ENE	NE	NE	NE	NE	NE	NNE	
4	NE	NE	NE	NNE	NE	NE	NE	NNE	NNE	ENE	N	N	N	N	N	NNE	NNE	NNE	NE	NE	NE	NE	NE	NE	
5	ENE	ENE	****	ENE	NE	NE	ENE	ENE	ENE	ENE	NE	ENE	NE	NE	NE	NE	NE	NE	NNE	NNE	NNE	NNE	NNE	NE	
6	NE	NNE	NE	NE	NE	NE	NNE	NE	NE	NE	NNE	NNE	NE	NNE	NNE	NE	NE	NE	NE	NE	NNE	NNE	N	N	
7	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	NNW	NNW	WNW	
8	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	SW	SW	SW	SW	SW	W	SW	
9	WSW	WSW	WNW	NW	WNW	W	W	W	W	NW	NNW	NW	W	W	SW	SW	SW	SW	SW	SW	SW	SW	WSW	WSW	
10	SW	SW	SW	SW	SW	SSW	SW	SW	SW	WSW	WSW	SW	SSW	SSW	SSW	SW	SW	SW	SW	SW	SW	SW	SW	SSW	
11	SSW	C	SE	ESE	SSE	C	C	E	ESE	ESE	E	E	NNE	N	WNW	WSW	WSW	SW	S	SW	SW	SSW	SSW	S	
12	S	SSE	SSE	SE	E	ESE	ESE	E	NE	ENE	ENE	ENE	ENE	ENE	ESE	E	ENE	ENE	ENE	V	V	N	N	N	
13	N	N	N	NNW	NW	WNW	NW	NNW	NNE	NE	NE	N	N	NNE	NE	V	V	ENE	NNE	N	NE	NNE	NE	NE	
14	ENE	E	ENE	NE	NE	ENE	ENE	ENE	ESE	ESE	ESE	ESE	V	N	N	N	N	N	N	NNE	NE	NE	NE	NE	
15	NE	NE	NNE	N	NNE	N	NNE	NE	E	SE	SE	ESE	ESE	ENE	NE	ESE	SE	S	SE	SE	SE	SE	SE	ESE	
16	ESE	ESE	ESE	ESE	E	E	E	ESE	SE	E	NE	NE	E	E	ENE	NE	ENE	NE	N	N	NNE	ENE	ESE	SE	
17	ESE	ESE	ESE	E	E	E	ENE	NE	NE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	N	N	N	N	V	C	
18	NE	NNE	ESE	NE	N	NNE	N	NE	V	ESE	V	V	V	NE	NE	NE	N	N	NE	NE	NNE	NNE	NNE	NNE	
19	NE	NE	NNE	N	NNE	NNE	NNE	NE	NE	ENE	NE	NE	NE	NE	NE	NNE	NNE	NE	NE	NNE	NNE	NNE	NNE	NNE	
20	NNE	NE	NNE	NE	NE	C	C	C	V	ENE	ENE	NE	NE	NE	NE	NE	NE	NE	NNE	NNE	NE	NE	NNE	NNE	
21	NE	NNE	C	NE	N	V	SSE	SSW	SSW	S	SW	SW	SSW	SSW	S	SSW	SSW	SSW	SSW	V	N	N	N	NNE	
22	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	ENE	ENE	ENE	ENE	NE	NE	NE	NE	NE	NE	NE	NNE	NNE	NE	
23	NE	NNE	N	N	N	NE	C	V	SSE	SSW	S	SSW	SW	SW	SSW	SSW	SSW	SSW	SSW	SW	SSW	SW	SW	SSE	
24	N	N	N	N	N	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	ENE	****	****	****	****	****	
25	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	NE	NE	NNE	NNE	NNE	NNE	
26	NE	NE	NE	NNE	NNE	NNE	NNE	NE	ENE	ENE	E	E	ESE	N	N	N	N	N	N	NNE	NE	NE	ENE	ENE	
27	ENE	E	E	ENE	ENE	ENE	ENE	SSE	S	SSW	SSW	SSW	SSW	SW	SW	WSW	W	WNW	NW	SSE	S	SSW	SW	WSW	
28	WSW	WSW	W	W	WSW	WSW	W	WSW	W	W	W	W	W	WSW	W	WNW	WNW	WNW	WNW	N	V	WSW	SW	SW	
29	WSW	WSW	WSW	WSW	S	S	S	SSW	SSW	SSW	S	SW	SW	W	W	WNW	WNW	WNW	NW	NW	NW	NW	WNW	NW	
30	NW	NW	NW	NW	NW	WNW	WNW	WNW	S	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	W	W	W	

PERCENTAGE OF DATA VALID 96.7

**** - INSUFFICIENT DATA AVAILABLE

WIND VELOCITY AND DIRECTION DISTRIBUTION

DRECTION	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	V	C	NR
%FREQUENCY	12.9	10.6	19.3	6.4	2.9	3.6	2.2	1.8	3.2	5.0	9.0	4.9	3.9	4.2	2.2	0.7	2.4	1.5	3.3
AV. VELOCITY	10.9	10.2	14.2	12.6	8.3	9.0	9.6	6.7	10.8	12.0	14.3	10.6	13.9	17.6	15.6	8.0	4.9	0.8	

TABLE: F-12 OWMC AIR POLLUTION SURVEY

MET. DATA WIND DIRECTION-10m UNITS PT. OF COMPASS

STATION LINCOLN COUNTY MONTH MAY 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	W	WSW	WSW	W	WSW	W	WSW	WSW	W	WNW	W	W	W	WSW	SSW	SW	SW	SW	SW	SW	SW	WSW	WSW	SW	
2	SW	SW	SW	WSW	WSW	WSW	C	WSW	V	V	V	V	NNE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NNE	N	
3	NNE	N	N	N	N	N	ENE	NNE	NE	NE	NNE	NNE	NE	NE	NE	NE	NE	ENE	ENE	ENE	ENE	NE	N	N	
4	N	NNE	NNE	NNE	NNE	NNE	NNE	NE	NE	NE	NE	NE	NE	NE	NNE	NE	ENE	ENE	NE	NE	NE	N	N	N	
5	NNE	NNE	NNE	C	NNW	NW	N	N	N	N	N	NE	NNE	NNE	NNE	NNE	N	N	N	W	WSW	WSW	WSW	W	
6	WNW	C	C	C	C	WSW	WSW	WSW	WSW	W	W	WSW	WSW	SSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	
7	W	W	WNW	WNW	W	WSW	V	N	N	N	N	N	N	NNW	N	NNE	V	SW	SW	S	V	V	NE	NNE	
8	N	N	C	WNW	W	W	WSW	WSW	SSW	SW	SW	V	SSW	SSW	SSW	SSW	SW	SW	SW	WNW	WSW	SW	WSW	WSW	
9	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	SW	SW	SW	
10	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	SW	W	NNE	NE	NE	SSE	SSW	V	V	SSW	SSE	S	V	V	
11	S	V	SE	V	SSE	S	S	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	SSW	SW	SW	
12	SW	WNW	WNW	NW	NW	NW	NW	N	N	N	N	N	N	N	N	NNE	NNE	NE	NNE	NE	NE	NE	NE	NE	
13	NE	NNE	V	ENE	C	NNE	NE	ENE	ESE	ESE	E	E	NE	N	N	NNE	NNE	N	NNE	NNE	NE	NE	C	C	
14	S	S	S	S	S	S	SSE	S	S	SSW	SSW	SSW	SSW	SSW	SW	SSW	SSW	SSW	SW	SSW	SW	****	****	****	
15	****	****	****	****	****	****	****	****	****	****	****	NNW	N	N	N	N	NE	NNE	NNE	NNE	N	N	NNE	V	
16	SE	WSW	WNW	NW	NNW	C	WSW	SW	SSW	SW	SW	SW	SW	SSW	SW	SW	SW	SW	SW	SW	SW	SW	SSW	SSW	
17	SW	SW	SW	WSW	S	S	S	SSW	SW	SW	SW	SSW	SW	SSW	SSW	SW	SW	SW	SW	SW	SW	S	S	SSW	
18	SW	V	W	NNW	N	NNE	NNE	NE	NE	NNE	NE	NE	ENE	NE	NE	NE	NE	NE	NE	NE	ENE	ENE	ENE	NE	
19	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	ENE	NE	NE	NE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	SE	SE	
20	SE	SE	SE	SSE	SE	SE	SE	SSE	SSE	SSE	SSE	SSE	SSE	SE	SE	SE	SE	SE	NE	NE	ESE	SSE	SSE	SSE	
21	S	S	SSW	SSE	SSE	S	SSE	SSE	SSE	S	S	SSE	SE	SSE	S	SSW	S	ENE	NE	NE	C	E	SSE	S	
22	S	S	S	S	SSW	SSW	SSW	SSW	SW	SSW	SSW	SSW	SW	WSW	WSW	W	V	NNE	SW	SW	S	SSW	S	S	
23	SSW	SSW	SW	WSW	WSW	WSW	WSW	WSW	SW	SW	SW	WSW	W	SW	WSW	W	W	WNW	WNW	NW	NW	NW	NW	WNW	
24	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	NNW	N	N	V	V	V	WSW	W	WNW	NNW	NNE	NE	NE	NE	NE	C	
25	C	C	C	C	NNE	NNE	NNE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NNE	NNE	NE	NNE	N	N	N	NE	
26	NNE	NNE	N	NNE	NNE	N	NNE	N	NNE	NNE	NE	NE	NE	NNE	N	NNE	V	N	ENE	NE	V	S	V	S	
27	SW	SSW	SSW	SSW	SSW	SSW	SSW	SW	SW	SW	SSW	SW	SW	SSW	SW	SSW	SSW	SSW	SSW	SSW	SSW	SW	SSW	SSW	
28	SSW	SSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SSW	SSW	SSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	
29	WSW	SW	SW	SW	SW	SW	SW	SW	WSW	WSW	WSW	W	W	WSW	SSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	
30	SSW	S	SSW	SW	SSW	SSW	SW	SW	SW	SW	SW	SSW	SSW	SSW	SSW	SW	SW	SW	SW	SSW	SSW	SW	WSW	WSW	
31	WSW	SW	SSW	SSW	SW	SW	SW	WSW	WSW	SSW	SW	SW	SW	SW	SSW	SSW	SW	SW	SW	SW	SW	SSW	SSW	SSW	

PERCENTAGE OF DATA VALID 98.1 **** - INSUFFICIENT DATA AVAILABLE

WIND VELOCITY AND DIRECTION DISTRIBUTION

DRECTION	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	V	C	NR
%FREQUENCY	7.7	7.5	12.5	3.1	0.4	0.4	2.2	3.0	4.8	10.8	24.5	7.3	3.4	2.8	1.3	0.9	3.4	2.3	1.9
AV. VELOCITY	9.1	8.9	11.1	13.7	9.7	12.0	7.3	7.9	6.6	11.5	14.5	9.0	10.5	8.2	7.6	7.6	5.5	0.6	

TABLE: F-13

OWMC AIR POLLUTION SURVEY

MET. DATA WIND DIRECTION-30m

UNITS PT. OF COMPASS

STATION LINCOLN COUNTY

MONTH JUN 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	
2	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	N	N	N	N	N	N	NNW	N	NNE	
3	NNW	NW	NNW	V	V	V	C	C	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	
4	****	****	****	****	****	****	****	****	****	SW	SW	SW	****	SW	SW	SW	SW	SW	SW	SW	WSW	SW	SW	WSW	
5	SW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	S	S	S	S	S	SSW	SSW	WSW	NNE	V	V	V	V	N	N	
6	N	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	NE	NNE	NE	NE	NE	NNE	NNE	NNE	
7	NNE	NNE	NNE	NNE	NNE	N	N	N	N	C	W	C	C	C	C	SW	SW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	
8	S	S	SSW	SW	SW	WSW	W	W	WNW	NW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	
9	V	WNW	NW	N	N	N	N	N	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	
10	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	
11	****	****	****	****	****	****	****	****	****	****	****	****	****	NE	NE	NE	N	N	NNE	NE	NNE	V	E	E	
12	E	E	ENE	NE	NE	NE	NE	E	ESE	SE	ESE	ESE	SW	SW	WSW	WSW	SW	SW	SSW	SW	SW	SW	SW	SW	
13	SW	SW	SW	SW	WSW	W	W	WSW	WSW	W	W	W	WNW	WSW	SW	SW	SW	SW	SW	WSW	W	WNW	WNW	NW	
14	NW	NW	NNW	****	SW	WSW	W	WSW	C	W	WNW	****	****	V	V	V	V	V	V	SSW	SSW	SW	SW	SSW	
15	WSW	WSW	W	W	WSW	WSW	SW	WSW	WSW	SW	V	SSE	S	SSW	SSW	SE	E	ENE	ENE	NE	E	V	SSE	SSE	
16	S	SSW	SSW	S	SSW	SSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	W	WNW	NW	NW	NW	WNW	
17	WNW	W	W	W	WNW	NW	NW	NW	N	N	N	N	WNW	WNW	WNW	WNW	SW	SW	SW	SW	WSW	WSW	SW	WSW	
18	WNW	W	WSW	W	W	W	W	W	W	WNW	WNW	W	W	W	SW	SW	SW	SW	SW	SW	WSW	WSW	SW	WSW	
19	WSW	WSW	SW	SSW	SSW	SW	SSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	SW	V	WSW	
20	WSW	WSW	WNW	V	NNE	N	N	N	N	N	N	NE	NE	NE	NNE	NNE	NE	NNE	NE	NE	C	C	C	C	
21	W	NW	NNW	N	C	C	C	C	C	C	SSW	SSW	V	V	V	S	SSW	SSW	SSW	SSW	C	SW	WSW	SW	
22	S	S	SSE	SSE	SSE	S	S	SSW	WSW	SSW	SSW	SSW	SSW	SW	SW	SW	SSW	SW	SW	SW	SW	SW	SW	W	
23	SW	SSW	SW	WSW	W	W	W	W	WNW	WNW	WNW	W	W	W	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	
24	SSW	SSW	SSW	WSW	WSW	WNW	W	W	W	W	WNW	WNW	WNW	WNW	WNW	NW	WNW	WNW	WNW	NW	WNW	WNW	W	W	
25	W	WSW	W	W	W	W	W	WNW	WNW	NW	NNW	NNW	NNW	NNW	NNW	NW	NW	****	****	****	****	****	****	****	
26	****	****	****	****	C	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	
27	****	****	****	****	****	****	****	****	****	****	****	****	WSW	SSE	S	WNW	W	WNW	WNW	W	WNW	SSW	SSW	C	
28	WNW	SW	SW	C	C	C	N	C	C	C	SW	WSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	SW	SW	
29	WNW	NW	WNW	WNW	W	W	WSW	WSW	W	W	W	W	W	SW	SW	SW	SW	ENE	SSE	SW	NW	NW	WSW	NW	
30	WNW	NW	NW	NW	W	WNW	NW	W	N	N	V	V	SE	V	V	V	SW	SW	SW	SW	SW	WSW	WSW	V	

PERCENTAGE OF DATA VALID 75.3

**** - INSUFFICIENT DATA AVAILABLE

WIND VELOCITY AND DIRECTION DISTRIBUTION

DRECTION	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	V	C	NR
%FREQUENCY	4.9	2.4	2.6	0.6	1.0	0.4	0.4	1.1	2.2	6.8	17.5	6.5	8.2	8.1	3.6	1.4	3.9	3.8	24.7
AV. VELOCITY	10.9	10.6	10.9	9.3	10.4	3.0	2.7	10.3	11.2	11.5	20.9	11.0	12.9	15.1	9.4	7.0	7.1	0.3	

TABLE: F-14

OWMC AIR POLLUTION SURVEY

MET. DATA WIND DIRECTION-30m

UNITS PT. OF COMPASS

STATION LINCOLN COUNTY

MONTH JUL 1986

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	C	C	C	C	C	C	C	C	SE	SE	SE	SE	SE	SE	SSE	ESE	NNE	N	NNE	E	C	C	SSE	SSE	
2	SSE	E	****	N	N	N	N	N	N	NNW	NNW	NNW	N	N	N	NW	WNW	WSW	SSW	C	WNW	NW	WNW	NW	
3	NW	NW	NNW	NNW	N	N	NNW	NNW	NNW	N	N	NW	NW	NW	NW	NW	NW	N	N	N	NNE	C	C	C	
4	C	C	C	C	C	WSW	WSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SSW	SW	SW	SW	SW	SW	SW	SW	
5	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SSW	SW	SW	SW	SW	SW	
6	SW	SW	SW	SSW	SW	SSW	SSW	SSW	SW	SW	SW	SW	SW	SW	SW	SW	SSW	SW	SW	SW	SW	SW	SW	SW	
7	SW	SW	SW	WSW	WSW	SW	SW	SW	SW	WSW	SW	SW	SSW	SSW	SSW	ENE	E	ENE	NW	NW	WNW	NW	WNW	WNW	
8	WNW	W	WSW	WSW	WSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	WSW	WSW	SW	SW	SW	SW	SW	
9	W	C	C	WNW	NNW	N	N	N	N	N	N	N	NNW	NNW	N	N	N	N	N	N	N	N	NW	WNW	
10	W	W	WNW	WNW	WNW	NW	NW	N	NE	NE	V	N	N	NNE	N	V	SSW	SSW	N	S	C	C	C	NNE	
11	NNE	NNE	NNE	NNE	NE	NE	NE	NE	NE	NE	NNE	N	NNE	ENE	V	SW	S	SE	ESE	E	E	ENE	ENE	ENE	
12	E	E	ENE	ENE	NE	NE	NE	NNE	N	N	NNW	N	N	N	N	N	NNE	NE	NE	NE	ENE	ENE	ENE	ENE	
13	****	****	****	N	****	****	****	****	****	****	****	****	SW	SW	Sw	SW	WSW	W	W	SW	SW	V	V	SW	
14	SW	WSW	W	W	W	W	W	W	WNW	WNW	WNW	WNW	WNW	NW	WNW	NNW	N	N	WNW	WSW	WSW	WNW	WNW	WNW	
15	W	W	W	WSW	WSW	WSW	W	W	W	WSW	SW	SW	SW	WSW	SW	SW	SW	SW	SSW	SW	SW	SW	SW	SSE	
16	S	SSE	SW	S	SE	SSE	SSE	SSE	SSW	SSW	SE	SE	SW	SW	SW	SW	SW	WSW	WSW	WSW	SSW	S	SSW	S	
17	C	C	C	SE	SE	SE	SSE	C	SSW	SSW	V	S	S	SSW	SSW	SW	WSW	SW	SW	SSW	SSE	S	SSW	SSW	
18	V	****	W	WNW	V	V	SSW	C	SW	SW	SW	WSW	WSW	S	SSE	SSW	SW	SW	SW	V	ENE	V	E	V	
19	ENE	SE	WSW	WSW	WSW	SW	WSW	WSW	W	WNW	W	SW	V	V	ESE	SSE	SSE	S	S	SSW	SW	S	S	SSE	
20	S	SSW	SW	SW	SW	S	SSW	WSW	WSW	WSW	W	W	W	WNW	N	N	NW	N	N	N	N	N	N	V	
21	NW	N	N	N	N	N	N	SW	N	N	N	N	V	N	V	V	V	V	V	NE	NE	ENE	ESE	S	
22	SSW	S	SE	ESE	ESE	SE	NE	NE	N	E	ENE	V	V	V	V	SSW	SSW	SW	SSW	SSW	SSW	SW	WSW	WSW	
23	WSW	SW	SW	SW	SW	SW	SW	SW	WSW	WSW	WSW	SW	V	SSW	SSW	S	SSW	SSW	S	S	SSW	SW	SW	SW	
24	C	C	C	C	C	C	C	C	C	C	C	C	C	C	SW	SW	SW	SW	SW	SSW	S	S	S	S	
25	S	S	S	S	S	S	SSW	SSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SSW	S	S	SSE	SE	S	S	
26	SW	SW	SW	SW	SW	SW	WSW	WNW	W	WNW	NNE	N	N	N	N	N	N	N	N	N	N	NE	NE	N	
27	N	N	N	NNE	NE	NNE	NNE	NNE	NNE	N	NNE	N	NNE	NNE	NNE	NNE	NNE	ENE	ENE	NE	ENE	V	V	WSW	
28	W	V	V	WNW	S	SSE	SSE	SSE	S	SSW	SSW	SSW	SSW	V	SSW	SSW	SSW	SSW	SSW	S	S	SSW	SSW	SSW	
29	WSW	SW	WSW	WSW	W	NW	V	W	WNW	WNW	WNW	WNW	W	W	WSW	WSW	WNW	WNW	NW	NNW	NNW	WNW	WNW	WNW	
30	WNW	NW	N	N	N	N	N	N	N	N	N	N	N	N	NNE	N	N	NNE	N	N	NE	NNE	N	N	
31	N	V	NNE	V	NNE	NE	V	NE	NE	NE	N	N	C	C	C	C	SW	SW	SW	SSW	C	C	C	SSW	

PERCENTAGE OF DATA VALID 98.3

**** - INSUFFICIENT DATA AVAILABLE

WIND VELOCITY AND DIRECTION DISTRIBUTION

DRECTION	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	V	C	NR
%FREQUENCY	14.1	4.0	3.6	2.6	1.2	0.8	2.3	2.6	5.2	7.9	21.8	6.5	4.0	5.1	3.1	2.0	4.7	6.7	1.7
AV. VELOCITY	7.9	6.3	5.3	5.9	5.7	3.0	5.0	3.9	4.9	7.2	11.5	5.8	7.5	9.7	10.7	9.7	5.3	1.8	

TABLE: F-15

OWMC AIR POLLUTION SURVEY

MET. DATA WIND DIRECTION-30m

UNITS PT. OF COMPASS

STATION LINCOLN COUNTY

MONTH AUG 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	SSW	S	S	SSW	SW	V	V	S	S	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	
2	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	
3	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	
4	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	
5	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	
6	****	****	****	****	****	****	****	****	****	****	****	****	****	SSW	SSW	S	SE	ENE	ENE	NNE	NNE	NNE	NNE	V	
7	V	V	V	V	ESE	ESE	SE	SE	SSE	SSE	SSE	SE	SSW	SSW	SW	WSW	WSW	WSW	SW	SSW	SSW	SW	SW	V	
8	W	NW	NW	NW	WSW	WSW	W	W	WNW	W	WSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	WSW	SW	SW	
9	SW	SW	SW	SW	WSW	W	WSW	WSW	W	W	W	W	W	W	W	W	W	W	SW	SW	WSW	SW	SW	WSW	
10	WSW	WSW	SW	SW	SSW	S	S	S	S	SSE	SSE	SSE	SE	SE	SE	SSE	V	SSE	WNW	S	WNW	WSW	W	W	
11	W	W	W	W	WSW	WSW	WSW	W	W	W	W	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	W	W	W	
12	W	W	W	W	WSW	WSW	W	WSW	W	WNW	WNW	WNW	WNW	NW	V	V	WSW	WSW	SW	SW	SSW	SSW	SSW	SW	
13	SW	WSW	NW	E	E	E	E	E	E	ENE	ENE	ENE	E	E	E	E	ENE	NE	NE	NE	ENE	ENE	E	ESE	
14	ESE	SE	SE	SE	SSE	SE	SSE	SSE	S	S	S	S	S	S	S	SSW	SSW	SW	SSW	S	SSE	SSE	SSE	SSE	
15	S	WNW	WNW	WNW	WNW	SW	SSW	V	SSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	NW	V	E	SE	SSE	
16	WNW	SW	SW	SW	SW	WSW	WSW	WSW	WSW	WSW	W	W	WSW	SW	SW	SW	SW	SW	SW	SSW	SSW	S	S	S	
17	WNW	SW	WSW	WSW	W	SSW	SSE	SSW	WSW	SSW	S	SSW	SW	WSW	W	NNE	N	N	NNE	NE	NE	ENE	V	WNW	
18	N	N	N	N	NNW	NNW	N	N	N	N	NNE	NNE	NNE	NNE	NNE	NNE	NE	NE	NE	NE	NNE	NE	NNE	N	
19	N	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NE	NE	NNE	N	N	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NE	NE	NE	
20	NE	NE	NE	NE	NE	NNE	NE	NE	NE	NE	NE	NE	NE	ENE	N	NNE	NNE	N	N	NNE	NNE	NNE	V	V	
21	S	S	S	S	S	S	S	S	S	SSW	SSW	WSW	WSW	W	N	NNE	N	N	N	NNE	NNE	N	N	N	
22	N	NNE	NNE	NNE	NE	NE	NE	NE	NE	NE	ENE	ENE	ENE	NE	NNE	NNE	N	NNE	NNE	N	NE	NE	ENE	E	
23	ESE	ESE	ESE	ESE	ESE	SE	SSE	SSE	S	SSW	SSW	SSW	SSW	SW	SW	SW	SW	SW	W	WNW	NW	NW	NW	WNW	
24	W	W	WSW	W	W	W	W	W	W	WNW	NW	NW	WNW	WNW	WNW	WNW	WNW	NW	NNE	WNW	NW	NW	NW	WNW	
25	WNW	WNW	WNW	WSW	WSW	W	W	W	WSW	WSW	SSW	SW	SSW	SSW	SSW	SSW	SSW	SW	SW	SW	SW	SW	SSW	S	
26	SSE	S	S	S	S	S	S	SSE	S	S	S	S	C	C	C	SSW	SSW	SSW	SSW	S	****	****	****	****	
27	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	NW	NNW	N	N	
28	NW	NW	NW	NW	NW	NNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	NW	WNW	NW	WNW	WNW	WNW	W	WNW	WNW	WNW	
29	WNW	W	WSW	W	W	WSW	WSW	W	W	W	WNW	WNW	NW	WNW	V	SW	SW	SW	SW	SW	SW	SW	WSW	WSW	
30	WSW	WSW	WSW	WSW	W	WSW	WSW	W	W	WSW	SW	SW	SW	SW	SW	SW	WSW	SW	SW	SW	SW	SW	WNW	NW	
31	V	V	SSE	SSE	C	V	V	SE	SE	SE	ESE	E	ESE	SE	SSE	SE	SSE	NE	NE	NE	NE	NE	ENE	ENE	

PERCENTAGE OF DATA VALID 81.5

**** - INSUFFICIENT DATA AVAILABLE

WIND VELOCITY AND DIRECTION DISTRIBUTION

DRECTION	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	V	C	NR
%FREQUENCY	3.9	6.3	5.5	2.2	1.9	1.5	2.4	3.4	6.2	5.8	11.7	7.7	8.2	7.7	3.4	0.5	2.8	0.5	18.5
AV. VELOCITY	13.0	0.0	12.6	9.0	7.0	7.0	7.0	5.5	0.0	0.0	14.6	10.0	11.3	17.3	12.9	14.0	4.6	0.8	

TABLE: F-16

OWMC AIR POLLUTION SURVEY

MET. DATA WIND DIRECTION-30m

UNITS PT. OF COMPASS

STATION LINCOLN COUNTY

MONTH SEP 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	E	E	C	C	C	ESE	SE	SE	SSE	S	SW	SSE	SE	SE	SE	SE	SSE	SSE	SSE	SSW	SE	C	ESE	ESE	
2	SE	SSE	C	NNE	NNE	NE	ENE	SE	C	SE	SE	ESE	ESE	ESE	SE	SE	ESE	ENE	NNE	NNE	ENE	ENE	E	ESE	
3	ESE	ESE	ESE	E	E	NE	NE	NE	NE	C	SE	SE	SSE	SSE	ESE	NE	N	N	NNE	SSE	SSE	S	S	SSE	
4	SSE	S	SSE	SSE	SSE	SSE	S	S	S	S	S	S	S	S	S	SSW	SSW	S	S	SSW	SSW	SSW	SSW	SSW	
5	SW	SW	SSW	SW	WSW	WSW	W	W	W	W	W	W	W	W	W	WSW	SW	WSW	WSW	WSW	WSW	SW	WSW	WNW	
6	****	****	****	****	NW	NW	NW	W	W	WNW	W	WNW	W	W	W	W	W	WNW	WNW	WNW	W	SSE	NNE	N	
7	ENE	NW	WNW	W	WNW	W	WNW	WNW	WNW	WNW	W	WNW	W	W	W	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	W	
8	WSW	WSW	WSW	W	C	WSW	C	SW	W	W	W	WSW	WSW	SW	SW	SW	****	SW	SW	SW	SW	SW	SW	SW	
9	SW	WSW	WSW	W	WSW	WSW	WSW	WSW	WSW	W	WSW	WSW	SW	SW	SW	SW	SW	SW	WSW	SW	SSW	SSE	SSE	SSE	
10	SE	SE	SE	SSE	SSE	S	S	S	S	SSW	SSW	SSW	WSW	SW	SW	V	V	SSE	V	SSE	SSW	SSW	SSW	SSW	
11	SW	SSW	SW	SW	SW	SSW	SW	SW	SSW	SW	SW	SW	SW	SSW	SW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	S	
12	V	SSW	SSW	SSW	SSW	SW	WSW	WSW	WSW	WSW	W	W	W	W	W	W	W	W	W	W	W	WSW	SW	SW	
13	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	W	W	W	W	WNW	WNW	WNW	NW	WNW	NW	NW	NW	
14	WNW	W	W	WNW	WNW	W	WNW	NW	WNW	SW	WSW	W	WSW	W	W	WSW	SW	SW	SW	SW	SW	WNW	NNW	N	
15	N	N	NNE	C	N	C	C	C	C	C	E	E	V	V	NE	NE	NE	NE	N	N	N	N	N	N	
16	N	N	N	V	WSW	WSW	WSW	NW	N	N	N	N	N	N	N	N	N	N	N	NNE	N	N	N	N	
17	N	N	N	N	NW	NW	C	C	WNW	NNE	ESE	SE	SE	SE	ENE	ESE	ESE	NE	NNE	NNE	NNE	NNE	NE	E	
18	ESE	SE	SSE	SE	SSE	SSE	SSE	SSE	SE	SE	SE	SSE	SSE	SSE	S	S	S	SSE	SSE	****	C	C	C	C	
19	C	SSW	SSW	SW	SSW	N	N	N	N	****	N	N	N	NNE	NNE	NE	NNE	NE	NE	NE	NNE	NNE	NE	ENE	
20	ESE	E	ENE	ENE	ENE	ENE	E	C	NNW	N	NNW	N	N	N	N	N	N	N	N	NNE	NNE	NNE	NNE	NE	
21	NE	NNE	NE	NNE	NNE	NNE	NNE	NE	NNE	NNE	NNE	NNE	NE	NE	NE	NE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	
22	NNE	NE	NE	ENE	ENE	E	E	ESE	SE	ESE	SE	SSE	SSE	S	SSW	SW	SW	SW	SW	WSW	C	NE	SSE	SW	
23	V	SSW	WSW	NNE	ESE	S	WSW	SW	SSW	SSW	SW	WSW	SW	SW	SW	WSW	WSW	WSW	W	W	WSW	WSW	SW	SW	
24	SW	C	C	C	C	C	C	C	C	SSE	SW	SW	SW	WSW	SW	SW	SSW	SSW	SSW	SSW	W	W	W	C	
25	C	C	NNW	N	C	E	ENE	ENE	ENE	E	NE	C	C	NNE	N	NE	NNE	NE	ESE	NE	NNE	NNE	NNE	NE	
26	ENE	E	ESE	SSE	NNW	N	W	N	WSW	SSW	SSW	SSW	SW	SW	SW	WSW	WSW	SW	SSW	WSW	N	ENE	N	N	
27	NNE	NNE	NE	NE	ENE	ENE	NNE	NNE	NE	NE	NE	NE	NE	NE	NNE	N	N	NE	NNE	NNE	NNE	NNE	N	N	
28	NNE	N	N	N	NNW	NNW	NW	C	C	SW	SSE	SW	WSW	SSW	SW	SW	SW	SW	SW	SW	SSE	SE	SE	SSE	
29	SSE	SSE	S	S	S	SW	SSW	SSE	SSW	S	S	S	SSE	V	SSW	SSW	SW	SSW	SE	SE	SSE	S	S	S	
30	SSW	SSW	SSW	SSW	SSW	SW	SW	SW	SW	SW	SW	SSW	SW	SW	SW	WSW	WSW	SSW	S	SSW	SW	SW	SW	NW	

PERCENTAGE OF DATA VALID 99.0

**** - INSUFFICIENT DATA AVAILABLE

WIND VELOCITY AND DIRECTION DISTRIBUTION

DRECTION	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	V	C	NR
%FREQUENCY	9.0	7.8	5.8	2.8	2.1	3.1	4.4	6.5	4.9	8.6	12.8	9.0	8.1	4.4	1.9	1.0	1.3	5.6	1.0
AV. VELOCITY	9.6	9.4	9.1	7.5	5.7	6.5	6.8	8.2	13.7	18.8	14.1	11.4	15.2	11.4	9.1	5.3	10.1	0.2	

TABLE: F-17

OWMC AIR POLLUTION SURVEY

MET. DATA WIND DIRECTION-30m

UNITS PT. OF COMPASS

STATION LINCOLN COUNTY

MONTH OCT 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	N	N	NW	C	NNW	NNW	NW	C	C	V	NE	NE	C	C	C	ESE	NE	NE	NE	NNE	NE	NE	NE	N	
2	N	NNE	N	NE	NE	N	N	N	N	N	N	N	N	N	V	C	C	S	S	SSW	S	S	S	SSE	
3	SE	ESE	ESE	ESE	ESE	ESE	SE	SE	SSE	SSE	SSE	S	S	SSE	SE	NE	SE	SSE	SSE	SSW	SSW	S	SSW	SSW	
4	SSW	NW	NNW	N	N	N	N	N	SE	NE	ENE	ENE	N	N	NNE	NE	NE	NE	N	NNE	SE	NNE	NNE	N	
5	N	N	N	N	NNW	NW	NW	C	W	WSW	WSW	W	W	WSW	WSW	SW	SW	SW	WSW	SW	WSW	WSW	WNW	NW	
6	WNW	W	W	W	W	W	W	WNW	WNW	NW	NW	NW	NW	WNW	WNW	NW	WNW	NW	WNW	WNW	NW	ESE	N	N	
7	S	V	C	C	C	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	
8	SW	SW	SW	SW	SW	SW	SW	SSW	SSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	N	N	SW	SW	SW	
9	SW	W	W	N	N	N	N	N	N	NNE	NNE	NNE	N	N	N	N	N	N	N	N	N	N	N	NNW	
10	N	N	NNE	NNE	ENE	ENE	E	E	E	E	E	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	E	E	
11	E	ESE	ESE	ESE	SE	SE	SE	SSE	SSE	S	S	SSW	SSW	SSW	S	SSE	SSE	SE	E	ENE	ESE	S	S	S	
12	S	S	S	S	S	S	SSE	S	V	S	S	S	S	S	SSE	SSE	SSE	SE	SE	SSE	S	S	S	S	
13	S	S	S	S	SE	SE	SE	SSE	SSE	SSE	SSW	WSW	WNW	W	WSW	WSW	WSW	WSW	S	SE	SE	SE	C	E	
14	ESE	ESE	SE	SSE	SSW	SSW	WSW	SW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	W	W	WSW	WSW	W	W	W	W	
15	W	WSW	WSW	W	W	WSW	WSW	WSW	WSW	W	W	W	W	W	W	WSW	W	W	WSW	W	WNW	NW	WNW	NNW	
16	W	SW	SW	SSW	SSW	V	SW	WSW	SW	WSW	WSW	WSW	WSW	W	C	SW	W	V	C	C	C	C	C	C	
17	C	C	C	C	NE	NE	NE	NE	NE	C	NNE	NE	NE	NE	NE	NNE	NNE	NNE	NNE	NNE	N	N	N	N	
18	N	N	N	NNW	NNE	N	NNW	NNW	NNW	N	N	N	NNE	NNE	V	C	V	E	SE	SSW	SSW	SSW	SSW	C	
19	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	W	WNW	WNW	W	W	W	SW	SW	SW	WSW	WSW	WSW	W	WSW	
20	W	W	WNW	W	W	W	W	WSW	WSW	WSW	WSW	WSW	WSW	SW	SW	SW	SW	SW	SW	WSW	WSW	WSW	WSW	WSW	
21	WSW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	WSW	WSW	WNW	W	W	W	WSW	SSW	SW	SW	SW	SW	SSW	W	
22	W	W	WSW	WSW	SW	SW	SW	SSW	SSE	SSE	SSE	SSW	SSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	SW	
23	SW	WSW	SW	SW	SW	SW	WSW	WSW	WSW	WSW	W	W	W	W	W	N	N	NW	N	N	N	N	N	N	
24	N	N	N	NE	NE	ENE	NE	NE	NE	ENE	NE	NE	NE	NE	NE	NNE	NNE	NE	NE	NE	NE	NE	ENE	ENE	
25	ENE	E	E	ENE	NE	ENE	E	ENE	NE	NE	NE	NE	NE	NE	NNE	NE	NE	N	NNE	N	NE	NE	ENE	ESE	
26	ESE	ESE	SE	SE	E	E	ENE	ENE	NE	ENE	ENE	NE	ENE	NE	NNE	NNE	NNE	NE	NNE	N	NNE	NNE	NNE	C	
27	NE	C	SSE	SW	C	SW	SW	SSE	SSE	SSW	SSW	SSW	SW	SW	SW	SW	SW	SW	WSW	WSW	W	WNW	SW	W	
28	WNW	W	W	W	WNW	W	W	WSW	W	W	WSW	WSW	WSW	WSW	SW	SW	SW	SW	SW	SSW	SSW	SW	SW	WSW	
29	WSW	WSW	WSW	WSW	SW	SW	SW	SW	WSW	WSW	WSW	WSW	SW	SW	WSW	WSW	WSW	W	WNW	WNW	WNW	NW	NNW	NW	
30	WNW	WNW	WNW	WNW	WNW	WNW	N	N	N	N	N	N	N	NNE	N	N	N	NE	C	C	ENE	C	C	ENE	
31	E	E	E	ESE	ESE	ESE	ESE	ESE	ESE	SE	SE	SE	SSE	SSE	SSE	SSE	ESE	SE	SSE	S	SSW	SSW	SSW	SSW	

PERCENTAGE OF DATA VALID 100.0

**** - INSUFFICIENT DATA AVAILABLE

WIND VELOCITY AND DIRECTION DISTRIBUTION

DRECTION	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	V	C	NR
%FREQUENCY	11.4	4.3	7.5	4.3	2.6	3.1	3.6	4.2	5.0	4.6	14.0	12.2	8.7	5.1	2.3	1.5	1.1	4.6	0.0
AV. VELOCITY	10.8	10.3	10.0	11.1	10.1	9.0	9.0	10.3	11.8	13.4	18.1	16.4	15.5	13.1	15.4	8.3	5.0	0.4	

TABLE: F-18 OWMC AIR POLLUTION SURVEY

MET. DATA WIND DIRECTION-30m UNITS PT. OF COMPASS

STATION LINCOLN COUNTY MONTH NOV 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SW	SW	SW	SW	SW	SW	SW	WSW	N	N	N	N	N	V	
2	WNW	NW	NNW	N	C	W	W	NW	NW	WNW	WNW	NW	WNW	W	W	WNW	WNW	WNW	WNW	NW	NW	NW	C	C	
3	C	SSE	SSE	SE	SE	SSE	SSE	S	SW	C	S	SSW	SW	SW	SW	SW	SW	SW	SW	WSW	WSW	W	W	W	
4	W	W	W	W	W	NW	NW	WNW	NW	N	N	N	N	NNE	NNE	NE	NE	NNE	NNE	NNE	NNE	NNE	NE	ENE	
5	ENE	NE	NE	ENE	ENE	ENE	ENE	ENE	ENE	E	E	ESE	E	E	E	E	E	SE	SSE	SE	SE	C	SSE	S	
6	C	C	C	WNW	C	C	C	C	WSW	WSW	WSW	W	W	WSW	SW	SW	SW	SW	C	C	C	C	C	C	
7	SE	SE	SE	SE	SE	C	C	SSE	C	C	C	C	C	C	NE	ENE	C	C	C	C	C	C	C	C	
8	C	NE	C	NE	E	C	ESE	ESE	SE	SSE	SSE	SSE	S	SSW	SW	SW	SW	SW	SW	SW	WSW	WSW	WSW	WSW	
9	W	W	SSW	SSW	SW	SW	SW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WNW	WNW	W	WNW	W	W	WSW	
10	W	W	W	WSW	SW	WSW	WSW	WSW	WSW	W	W	W	W	W	W	W	SW	SSW	C	C	C	C	ESE	ESE	
11	SE	C	C	SW	WNW	C	C	C	C	C	C	C	C	W	WNW	WNW	W	WNW	WNW	W	W	W	NW	NW	
12	C	C	C	C	C	C	C	C	C	SW	C	C	W	W	WSW	WSW	WSW	W	W	W	W	W	WNW	WNW	
13	WNW	WNW	W	WNW	WNW	WNW	W	W	WNW	NW	NW	WNW	W	WNW	W	W	WNW	W	W	W	W	W	W	W	
14	W	W	WSW	WSW	W	W	W	W	WNW	WSW	SW	WSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	
15	SW	SW	WSW	WSW	W	W	W	W	W	WSW	SW	WSW	WSW	SW	SW	SW	SW	SW	SW	SW	SW	W	W	WSW	
16	WSW	WSW	W	W	W	W	W	WSW	WSW	C	C	C	C	ESE	C	C	C	C	C	WSW	WSW	W	W	WSW	
17	W	W	WSW	SW	SSW	SSW	SSW	SW	WSW	SW	SW	SW	SW	SW	SW	WSW	WSW	WNW	WNW	WNW	W	W	W	WSW	
18	W	W	WNW	WNW	C	N	N	NNE	NNE	NNE	NE	NE	ENE	NE	NE	NE	NE	NE	NE	NE	NNE	N	N	N	
19	N	N	N	N	N	N	N	N	N	NE	NE	NE	NE	NNE	NE	NE	NNE	NE	NE	NE	ENE	E	E	E	
20	E	ENE	ENE	E	E	E	E	ENE	ENE	E	ESE	E	E	E	E	E	E	ENE	ENE	NE	NNE	NNE	NNW	N	
21	N	N	N	N	N	N	N	NW	NW	NW	NW	NW	WNW	NW	NW	WNW	NW	NNW	NW	W	WNW	WNW	WNW	W	
22	W	W	W	WNW	NW	C	C	S	S	SE	SE	SSE	SSE	SW	SW	SW	S	SSE	SSE	S	S	SSE	SSE	SE	
23	SE	ESE	ESE	ESE	SSE	S	S	S	S	S	S	S	SSW	SSW	SSW	SSW	SSW	SSW	SW	SW	SW	SW	S	SW	
24	WSW	WSW	W	W	W	WSW	WSW	WSW	W	W	W	WSW	WSW	W	W	W	W	W	W	WSW	WSW	W	WSW	WSW	
25	WSW	WSW	WSW	WSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SSW	SSW	SSW	SSW	SSW	S	S	SSE	SE	E	ENE	
26	ENE	ENE	ENE	E	ESE	SE	E	NE	NE	NE	NNE	NNE	NE	N	NNE	NNE	NNE	N	N	N	N	WNW	W	WNW	
27	WNW	WNW	WNW	WNW	WNW	NW	WNW	WSW	W	W	C	SSW	SW	SW	WSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	
28	WSW	WSW	WSW	W	WSW	WSW	WSW	WSW	WSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	WSW	WSW	WSW	
29	WSW	W	WSW	WSW	W	W	WSW	WSW	WSW	W	WSW	W	WNW	WNW	WNW	NW	NW	W	W	W	WSW	N	N	N	
30	N	N	N	N	N	N	N	N	N	N	NNE	NNE	NE	NE	NE	NE	NE	NE	ENE	ENE	ENE	ENE	ENE	ENE	

PERCENTAGE OF DATA VALID 100.0 **** - INSUFFICIENT DATA AVAILABLE

WIND VELOCITY AND DIRECTION DISTRIBUTION

DRECTION	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	V	C	NR
%FREQUENCY	6.9	3.1	5.1	3.8	3.6	1.5	2.5	2.5	2.6	4.2	14.3	12.4	15.4	7.2	3.8	0.4	0.1	10.6	0.0
AV. VELOCITY	14.6	13.5	14.9	11.9	12.0	6.8	7.1	9.6	11.8	16.9	21.2	17.7	15.4	14.1	12.1	7.3	4.0	0.2	

TABLE: F-19 OWMC AIR POLLUTION SURVEY

MET. DATA WIND DIRECTION-30m UNITS PT. OF COMPASS

STATION LINCOLN COUNTY MONTH DEC 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	E	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	E	E	E	E	
2	E	E	E	ESE	ESE	E	E	ESE	E	E	E	ENE	ENE	NE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	NE	ENE	
3	E	E	E	C	C	SSW	WSW	WSW	WSW	WSW	WSW	WSW	SW	SW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	
4	WSW	WSW	WSW	WSW	WSW	WSW	WSW	W	WSW	WSW	WSW	WSW	WSW	W	W	WNW	W	W	W	W	W	W	W	W	
5	W	W	W	WSW	WSW	WSW	WSW	WSW	WSW	W	W	W	WSW	WSW	WSW	WSW	WSW	WSW	W	WSW	W	WSW	WSW	SW	
6	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	W	WNW	WNW	WNW	WNW	C	
7	C	C	V	SE	ESE	ESE	SE	S	SSW	SW	SW	SW	SW	SW	WSW	WSW	WSW	WSW	WSW	W	W	W	WSW	W	
8	WSW	W	NW	N	N	NNE	NNE	NE	NE	NE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	NE	
9	NE	NE	NE	NNE	NNE	NNE	NNE	NE	C	C	E	C	NE	NE	NNE	NNE	N	NW	W	WSW	WSW	WSW	W	W	
10	WSW	WSW	WSW	WSW	WSW	WSW	WSW	W	W	W	W	W	W	W	W	W	WSW	WSW	W	W	W	W	W	W	
11	W	W	W	W	WSW	WSW	WSW	C	C	SSW	SSW	SSW	SSW	SW	SSW	SSW	SSW	SW	SW	SW	SW	SW	SW	WSW	
12	WSW	WSW	WSW	WSW	WSW	W	W	W	W	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	W	W	W	W	W	WNW	
13	WNW	NNW	N	NW	WNW	WNW	WNW	WNW	WNW	NW	WNW	WNW	NW	NW	W	W	WSW	WSW	C	SSW	WSW	C	SW	WSW	
14	SW	SW	SW	SW	SW	SSW	SSW	SSW	SW	SSW	SSW	SSW	SW	SW	WSW	WSW	WSW	W	WSW	WSW	WSW	WSW	WSW	WSW	
15	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	SW	WSW	WSW	SW	SW	WSW	C	WSW	WSW	
16	W	W	W	W	W	WSW	W	C	C	C	C	C	C	C	C	NE	NE	NNE	NE	NE	NE	NE	ENE	E	
17	C	C	C	ENE	E	E	ESE	SE	SE	SSE	SE	SSE	SSE	SSE	SSE	SSE	SSE	S	C	SE	ESE	ESE	ESE	E	
18	ESE	ESE	ESE	ESE	SE	SE	SSE	S	SSW	SW	WSW	WSW	WSW	WSW	WSW	SW	WSW	WSW	WSW	W	WNW	WNW	WNW	WNW	
19	WNW	WSW	W	W	W	W	W	W	W	W	W	W	W	WSW	WSW	WSW	WSW	WSW	W	W	W	W	WNW	WNW	
20	W	W	W	WNW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	W	W	WNW	C	C	C	NW	NNW	C	NNW	C	NNW	C	
21	NNW	NNW	NNW	NNW	NNW	NNW	NW	NW	NW	NNW	NW	N	V	V	W	W	WNW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	
22	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	SW	SW	SW	SW	SW	SW	WSW	WSW	SW	WSW	
23	WSW	SW	WSW	WSW	WSW	WSW	W	W	W	WSW	WSW	SW	SW	SW	SW	SW	SW	WSW	W	WSW	SW	C	C	C	
24	E	E	E	ENE	E	E	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	NE	NE	NE	NE	V	V	NE	
25	ENE	ENE	ENE	ENE	C	C	C	W	WSW	WSW	WSW	W	W	W	W	W	W	WSW	WSW	WSW	WSW	WSW	WSW	W	
26	WSW	WSW	SW	SW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	W	W	W	W	W	WSW	W	W	C	WNW	WNW	W	WSW	
27	WSW	WSW	C	C	WSW	C	W	W	C	C	C	C	C	C	SSW	C	C	C	C	C	C	C	C	SW	
28	SW	W	C	WSW	W	W	W	W	WSW	SW	SW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	SW	WSW	
29	SW	SW	SW	SSW	SW	V	V	N	SSW	SSW	SSW	SSW	SSW	SW	SSW	SSW	S	C	C	W	ENE	NE	NE	NNE	
30	NNE	NNE	NNE	C	N	N	NNE	NE	NE	NNE	NNE	N	N	N	N	N	N	N	N	NNW	NNW	NNW	NW	NW	
31	NW	NW	WNW	W	WSW	V	V	C	WSW	WSW	SSW	SSE	S	S	SSE	SSE	SE	SE	ESE	SSE	SSE	S	S	S	

PERCENTAGE OF DATA VALID 100.0 **** - INSUFFICIENT DATA AVAILABLE

WIND VELOCITY AND DIRECTION DISTRIBUTION

DRECTION	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	V	C	NR
%FREQUENCY	2.2	2.2	3.6	8.3	3.5	1.9	1.3	1.7	1.2	3.6	9.0	27.7	15.7	4.8	2.0	1.9	1.2	8.1	0.0
AV. VELOCITY	10.6	7.8	11.7	18.7	13.2	11.4	8.6	8.0	6.9	17.4	22.3	19.4	18.8	12.7	8.9	7.0	8.0	0.3	

TABLE: F-20 OWMC AIR POLLUTION SURVEY

MET. DATA WIND DIRECTION-30m UNITS PT. OF COMPASS

STATION LINCOLN COUNTY MONTH JAN 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	SSE	SSE	SE	ESE	E	E	E	ENE	E	ESE	ESE	C	C	ENE	E	NNE	NNE	NE	NE	NE	NE	NNE	NE	NNE	
2	****	****	****	****	****	****	****	****	NE	NE	NNE	NNE	NNE	N	N	N	N	NNW	NNW	N	NNW	NW	SSW	WNW	
3	WNW	W	W	W	WNW	WNW	WNW	WNW	WNW	WNW	W	W	WSW	W	W	W	W	WNW	W	WNW	WNW	W	W	WNW	
4	W	W	W	WNW	W	WNW	NW	NW	NNW	NNW	C	C	C	C	C	WNW	C	C	WNW	C	W	WNW	NW	WNW	
5	WNW	W	WNW	NW	C	C	C	W	W	W	SW	SW	WSW	WSW	WSW	SSW	S	S	C	C	C	C	SE	SE	
6	SE	SE	SE	SE	SE	SSE	SSE	SSE	SSE	S	SSE	S	S	S	SSE	SSE	SE	SSE	S	SSW	SSW	SW	SW	WSW	
7	WSW	WSW	WSW	WSW	WSW	WSW	WSW	W	W	W	W	WNW	WNW	WNW	WNW	NW	NW	NW	NW	NW	NW	WNW	NW	NW	
8	NW	NW	NW	NW	NW	NNW	NW	WSW	W	WSW	WSW	WSW	WSW	W	WSW	WSW	WSW	W	W	W	W	W	W	W	
9	W	W	W	W	W	WSW	WSW	WSW	WSW	WSW	W	WSW	SW	SW	SW	SW	SSW	C	C	ESE	E	E	E	E	
10	E	ENE	E	E	E	ESE	E	E	ENE	ENE	ENE	E	ESE	SE	S	SW	SW	SW	WSW	W	W	W	W	WNW	
11	WNW	WNW	W	NW	NNW	NNW	NNW	NNW	NW	NW	NW	WNW	WNW	WNW	WNW	W	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	
12	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	W	W	W	W	WNW	NW	WNW	NW	NW	WNW	NW	WNW	WNW	WNW	
13	WNW	W	W	WNW	WNW	WNW	WNW	W	W	W	W	W	W	WSW	WSW	WSW	SW	SW	SW	SSW	SSW	SSW	S	SSW	
14	SSW	SSW	SSW	SSW	SSW	SW	SW	WSW	WSW	WSW	WSW	WSW	WSW	SW	WSW	SW	SW	WSW	WSW	WSW	WSW	SW	SW	SW	
15	SW	SW	SW	SW	SW	SW	WSW	WSW	SW	WSW	WSW	WSW	W	W	WNW	WNW	W	W	W	WNW	WNW	NW	WNW	NW	
16	NW	WNW	NW	NW	NW	NW	NW	NW	N	NE	NE	NE	V	V	E	SE	SE	C	C	C	NW	NW	NW	NW	
17	N	NNE	ENE	ENE	ENE	ENE	ENE	E	ESE	ESE	ESE	E	E	E	ENE	E	ENE	ENE	E	E	E	E	E	E	
18	E	E	E	SE	V	C	V	S	S	SSW	SSW	SW	W	W	W	W	W	WNW	NW	NW	WNW	WNW	WNW	NW	
19	W	WNW	NNW	C	N	NNE	ENE	ENE	ENE	ENE	ENE	ENE	NE	NE	NE	ENE	NE	NNE	NE	NNE	NE	NNE	NNE	N	
20	N	NNW	NW	NW	NW	NW	WNW	WSW	WNW	W	WSW	WSW	WSW	WSW	WSW	SW	WSW	SW	WSW	SW	SW	SW	WSW	W	
21	W	W	WSW	WSW	WSW	WSW	WSW	WSW	W	W	WSW	WSW	WSW	WSW	WSW	WSW	SW	WSW	WSW	WSW	SW	SW	SSW	SSW	
22	S	S	S	S	SSE	SE	SE	SE	SE	SSE	S	S	S	SSW	S	S	SSE	SE	ESE	ESE	C	C	C	C	
23	W	W	W	W	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	W	W	W	WSW	WSW	W	W	W	W	W	
24	W	W	W	W	W	W	W	W	W	W	W	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	
25	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	W	WSW	W	WNW	WNW	C	C	C	C	NNW	NNW	NNW	N	
26	N	NNW	NNW	NW	NNE	N	NNE	N	N	N	N	NNE	NNE	NE	NNE	NE	NNE	C	C	WNW	NW	W	WSW	W	
27	WNW	W	W	WSW	SW	SW	SW	SW	WSW	WSW	WSW	WSW	W	WSW	WSW	WSW	WSW	WSW	SW	SW	SW	SW	SSW	WSW	
28	SW	SW	SW	SW	SW	C	SSW	SW	WSW	WSW	SW	W	W	WSW	WSW	WSW	WSW	WSW	WSW	W	WSW	W	W	W	
29	W	W	W	W	W	W	WNW	WNW	WNW	C	N	ENE	ENE	C	E	ESE	E	NE	ENE	ENE	ENE	ENE	E	ENE	
30	ENE	E	E	ESE	ESE	ESE	SE	SSE	S	SSW	SW	SSW	SSW	SSW	SSW	SSW	SW	W	WSW	WSW	W	W	WNW	WNW	
31	WNW	WNW	WNW	WNW	WNW	WNW	NW	NW	NW	NW	NNW	NNW	NW	NW	NW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	C	WSW	

PERCENTAGE OF DATA VALID 98.9 **** - INSUFFICIENT DATA AVAILABLE

WIND VELOCITY AND DIRECTION DISTRIBUTION

DRECTION	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	V	C	NR
%FREQUENCY	2.4	2.6	2.6	3.9	4.8	2.0	2.6	1.9	2.8	3.6	7.4	18.7	16.1	11.8	7.5	2.6	0.5	5.1	1.1
AV. VELOCITY	11.6	14.1	18.6	13.6	11.7	8.9	10.6	10.7	11.0	18.3	15.3	20.6	18.9	16.3	14.3	11.3	3.8	0.3	

TABLE: F-21

OWMC AIR POLLUTION SURVEY

MET. DATA WIND DIRECTION-30m

UNITS PT. OF COMPASS

STATION LINCOLN COUNTY

MONTH FEB 1987

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	WSW	WSW	SSW	S	SSE	SE	SE	SSE	SSE	S	S	S	SSW	SSW	SW	SW	SW	SW	SW	WSW	WSW	WSW	SW	SW	
2	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	SW	SW	WSW	SW	SW	SW	SSW	SSW	SSW	SSW	SSW	S	SSE	
3	SE	SE	V	S	WSW	WSW	WSW	WSW	W	W	W	WNW	NW	NW	NW	WNW	WNW	WNW	WNW	NW	WNW	W	WNW	W	
4	WSW	W	W	W	WNW	W	W	WNW	W	W	WSW	WSW	W	WNW	WNW	WNW	WNW	NW	NW	WNW	NW	WNW	W	W	
5	W	W	W	C	C	C	C	SSW	WSW	WSW	SW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SW	SW	
6	SSW	SW	SW	SW	WSW	WSW	SW	SW	WSW	WSW	SSW	S	SSE	SSW	S	SSW	SW	SW	SW	WSW	WSW	WSW	WSW	WSW	
7	W	W	W	WSW	WSW	W	W	W	W	W	WNW	WNW	W	W	WSW	WSW	SW	SW	SW	SSW	SSW	SSW	SSW	S	
8	S	S	S	S	SSW	SSW	SSW	SSW	SW	SW	SW	WSW	WSW	WSW	SW	V	N	N	N	N	N	N	N	N	
9	N	N	N	N	N	N	N	N	N	N	N	N	V	WSW	W	SW	SW	SSW	SSW	SW	SW	SW	SW	SW	
10	SW	SW	SW	SW	SW	SW	SW	WSW	WSW	WSW	WSW	WSW	WSW	W	W	W	WNW	W	S	S	S	W	WNW	W	
11	W	WSW	W	W	W	WSW	WSW	W	W	WNW	W	C	C	C	C	C	ESE	C	C	C	SE	SE	SE	ESE	
12	ESE	ESE	ENE	ENE	NE	NE	NE	NE	NNE	NNE	NNE	NNE	NNE	NNE	NE	N	WSW	SSW	SSW	SW	W	WNW	WNW	NNW	
13	NW	NW	NW	WNW	NW	NW	WNW	W	NNW	N	N	N	N	V	C	C	C	ESE	C	NE	C	C	C	C	
14	NE	NE	ENE	NE	NE	ENE	ENE	ENE	ENE	ENE	ENE	NE	ENE	NE	NE	NE	NE	NE	NNE	NNE	N	N	N	N	
15	N	N	N	N	N	N	N	N	N	N	N	N	N	N	W	WSW	WSW	C	C	C	NNW	N	N	NNE	
16	NNE	NE	NNE	NE	ENE	E	ESE	ENE	ENE	ENE	NE	NE	NE	NNE	NE	NE	NE	NNE	NNE	NNE	NE	NE	ENE	ENE	
17	NE	ENE	ENE	ENE	NE	NE	ENE	ENE	ENE	ENE	NE	NE	NE	NE	NE	NNE	NNE	NNE	NNE	NE	NE	ENE	ENE	C	
18	C	C	NE	NE	NE	NE	NE	NE	NE	NNE	NE	NNE	NNE	N	N	N	N	C	WNW	WNW	NW	NNW	N	W	
19	W	C	C	WSW	W	SW	WSW	WSW	WSW	SSW	SSW	SSW	W	NW	SW	SW	SW	SW	SW	SW	SW	WSW	W	W	
20	W	WSW	W	N	N	W	WNW	W	WSW	C	C	V	V	V	V	V	S	SSE	SSE	SSE	S	S	S	S	
21	SSW	SSW	C	C	C	C	C	C	C	C	C	C	V	C	C	C	C	NNE	NNE	NE	NE	ENE	ENE	ENE	
22	E	E	E	E	ENE	ENE	C	C	ENE	C	C	V	E	ENE	ENE	C	C	N	N	NNE	N	N	NNE	NE	
23	NNE	NNE	N	N	N	N	N	N	N	WNW	NW	WNW	W	SW	SW	SSW	S	SSW	SSW	SW	SW	WSW	SW	SW	
24	SW	SW	SW	SW	SW	WSW	WSW	WSW	WSW	N	N	N	N	V	V	V	SW	SW	WSW	WNW	WSW	W	W	W	
25	W	WSW	W	WSW	W	W	WNW	W	W	W	WSW	W	WNW	WNW	W	W	WNW	WSW	SW	C	WSW	W	C	NNW	
26	N	NNE	WNW	W	WNW	N	N	N	N	N	N	N	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NE	NE	NE	NE	
27	ENE	ENE	ENE	ENE	NE	NE	NE	NE	ENE	NE	ENE	ENE	NE	NE	NE	NE	NE	NNE	NNE	NNE	NE	ENE	ENE	ENE	
28	ENE	ENE	E	ESE	SE	SE	ESE	C	ENE	NE	NE	E	E	ENE	ENE	NE	NE	ENE	NE	ENE	ENE	ENE	****	****	

PERCENTAGE OF DATA VALID 99.7

**** - INSUFFICIENT DATA AVAILABLE

WIND VELOCITY AND DIRECTION DISTRIBUTION

DRECTION	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	V	C	NR
%FREQUENCY	11.2	6.0	10.0	7.7	1.3	1.2	1.3	1.2	3.3	6.5	11.5	9.5	10.6	5.4	2.2	0.7	2.1	8.0	0.3
AV. VELOCITY	16.0	12.8	12.5	8.8	4.9	5.1	8.2	10.4	12.0	17.0	16.8	12.9	10.9	15.3	16.0	12.2	6.7	0.3	

TABLE: F-22 OWMC AIR POLLUTION SURVEY

MET. DATA WIND DIRECTION-30m UNITS PT. OF COMPASS

STATION LINCOLN COUNTY MONTH MAR 1987

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	NE	NE	NE	NE	NE	NNE	NNE	NNE	NNE	NE	V	NE	V	C	C	SSW	SSW	SW	SW	WSW	SW	SW	SW	SW	
2	SW	SW	SW	SW	SW	WSW	WSW	W	W	W	W	W	W	W	WSW	WSW	WSW	WSW	WSW	WSW	WSW	W	W	WSW	
3	WSW	SW	SW	SW	SW	WSW	W	W	W	W	W	W	W	W	WNW	W	W	WNW	WNW	WNW	W	W	W	WNW	
4	NW	WNW	WNW	W	WNW	WNW	W	WSW	SW	WSW	WNW	W	WSW	W	SW	WSW	WSW	WSW	SW	WSW	WSW	WSW	C	C	
5	C	C	C	C	C	ENE	ESE	ESE	C	C	SSE	S	SE	SE	ENE	NE	C	C	NNE	NNE	NNE	C	C	C	
6	C	C	SSE	C	V	V	V	SSE	SSE	S	S	SSW	SSW	SSW	SW	SW	SW	SW	SSW	S	S	S	S	S	
7	SSW	SSW	SSW	S	S	S	S	S	SSW	SW	SSW	S	S	SSW	SSW	SSW	SSW	SSW	SW	SW	SSW	SSW	SW	SW	
8	S	S	SSW	SSW	SW	SW	V	SSE	S	S	SSW	SSW	SSW	SSW	SSW	SSW	SSW	S	SSW	SSW	V	V	N	N	
9	N	N	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NE	NE	NNE	NE	NE	NE	NNE	NNE	NE	NNE	NE	
10	NE	NE	NNE	NNE	NE	NE	NE	NE	NE	NE	NE	NE	NNE	NE	NE	NNE	NE	NE	NE	NE	ENE	ENE	ENE	ENE	
11	ENE	ENE	ENE	ENE	ENE	ENE	ENE	E	E	ENE	ENE	ENE	ENE	NE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	
12	C	C	C	C	C	NW	NNW	WNW	WNW	C	SSW	SSW	SSW	SSW	SSW	SSW	WSW	WSW	SW	SW	SW	WSW	SW	SW	
13	SW	WSW	SW	SW	WSW	WSW	WSW	WSW	SW	SSE	SSE	SW	SW	SSW	S	SW	SSW	SSW	S	W	N	C	NW	V	
14	SSW	SW	C	V	E	E	E	E	ENE	ENE	E	E	V	E	ESE	V	NNE	NNE	NNE	NNE	NNE	NNE	NE	NNE	
15	NNE	NNE	NNE	NNE	NNE	NNE	NE	NE	NE	NE	NE	NE	NNE	NNE	NNE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
16	NE	NE	NE	NE	NNE	NNE	NE	NE	NE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	N	NW	NW	W	W	W	W	
17	N	N	N	N	N	N	N	N	NNW	NNW	NNW	N	NW	NW	NNW	N	N	N	N	N	N	WNW	WSW	W	
18	W	W	V	V	N	WNW	NW	N	NNE	NNE	NNE	NNE	N	NNE	NNE	NNE	NNE	NE	NNE	NE	ENE	ENE	ENE	E	
19	C	C	C	N	NNE	N	N	NNE	NNE	NNE	NE	E	NNE	N	N	N	NNE	NNE	V	W	W	WNW	WNW	NNW	
20	NNE	W	WSW	WSW	WSW	W	W	W	NNW	WNW	NW	WNW	WNW	WNW	NW	N	NNE	NNE	NE	NE	ENE	ENE	NE	NE	
21	NNE	N	N	N	NNW	NW	WNW	WNW	NW	N	N	N	NNW	N	N	N	N	N	NNW	NNW	NNW	WNW	W	WNW	
22	WNW	WNW	WNW	WNW	N	NNW	NW	N	N	N	NE	NE	NNE	N	NE	NE	NE	NE	NE	NE	NNE	NE	N	NNE	
23	N	NNE	NNE	NE	NE	NE	E	ENE	C	ENE	V	E	V	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NE	ENE	E	E	
24	E	E	E	E	ENE	ENE	ESE	ESE	ESE	SE	SE	ESE	ESE	NNE	NNE	NNE	NNE	N	NNE	NE	ENE	ESE	SE	SSE	
25	SE	SE	SE	SSE	S	S	SSE	SE	SSE	SW	SSW	SE	SE	SE	SE	SE	SSE	SSE	SSE	S	SSW	S	S	SW	
26	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	SW	SW	SW	SW	SW	SW	SW	SSW	SW	SW	SW	WSW	
27	WSW	SW	SW	WSW	C	C	SSE	SSE	S	SW	SW	SW	SSW	SW	SW	WSW	C	C	NE	NE	NE	NE	NE	NE	
28	NE	NNE	NNE	N	N	N	N	N	N	NNE	NE	NE	NE	NNE	NNE	NNE	NNE	NNE	NNE	N	NNE	NE	NNE	ENE	
29	ENE	C	C	WNW	NNE	NNE	NE	ENE	E	ESE	E	ESE	NE	NNE	N	NNE	NNE	NE	ESE	ESE	SE	V	S	SSW	
30	SW	SSW	SSW	SSW	SSW	SSW	SSW	SW	SW	SW	SW	W	NW	NW	N	N	N	N	N	N	N	N	N	N	
31	NNW	N	N	N	NNW	NNW	NNW	NW	NNW	NW	NW	NW	WNW	W	W	W	W	WNW	W	W	W	WSW	WSW	W	

PERCENTAGE OF DATA VALID 100.0 **** - INSUFFICIENT DATA AVAILABLE

WIND VELOCITY AND DIRECTION DISTRIBUTION

DRECTION	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	V	C	NR
%FREQUENCY	9.5	15.5	12.1	4.4	2.8	1.7	2.0	2.2	3.9	6.7	10.3	5.5	6.7	4.2	2.6	2.4	2.4	5.0	0.0
AV. VELOCITY	14.6	16.6	15.1	8.0	7.3	7.8	14.5	12.6	13.8	14.9	17.8	14.2	17.0	11.7	11.5	12.6	7.6	0.4	

TABLE: F-23 OWMC AIR POLLUTION SURVEY

MET. DATA WIND DIRECTION-30m UNITS PT. OF COMPASS

STATION LINCOLN COUNTY MONTH APR 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	WSW	WSW	W	W	C	C	SSW	C	SE	SE	S	SSW	S	S	S	S	S	S	SSE	SSE	SE	SE	SE	SSE	
2	S	SSE	S	SSW	SW	SW	SSW	SW	WSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	WSW	W	WSW	
3	WSW	WSW	SW	SW	WSW	W	W	W	W	W	W	W	WSW	WNW	WNW	V	V	NNE	NNE	NNE	NE	NE	NE	NNE	
4	NE	NNE	NE	NE	NE	NNE	NNE	N	N	N	N	N	N	N	N	NNE	NNE	NNE	NE	NE	NE	NE	NE	NE	
5	NE	NE	****	ENE	ENE	NE	NE	ENE	ENE	ENE	NE	ENE	NE	NE	NE	NE	NE	NE	NNE	NNE	NE	NNE	NNE	NE	
6	NE	NE	NE	NE	NE	NE	NNE	NNE	NE	NE	NNE	NNE	NE	NNE	NNE	NE	NE	NE	NNE	NE	NNE	NNE	N	N	
7	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	NNW	NNW	N	
8	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	SW	SW	SW	SW	SW	W	W	
9	WSW	WSW	WNW	NW	NW	WNW	WNW	WNW	WNW	NW	N	NNW	WNW	W	WSW	SW	SW	SW	SW	SW	SW	WSW	WSW	WSW	
10	WSW	WSW	WSW	SW	SW	SW	SW	SW	WSW	WSW	WSW	SW	SW	SSW	SSW	SW	SW	SW	SW	SW	SW	SW	WSW	SW	
11	SW	C	SSE	SE	SSE	SSE	SE	ESE	ESE	ESE	E	ENE	N	N	V	W	WSW	SW	S	SW	SW	SW	SSW	SSW	
12	S	S	SSE	SE	ESE	ESE	ESE	E	ENE	ENE	ENE	ENE	ENE	ENE	ESE	E	E	ENE	ENE	V	V	N	N	N	
13	N	N	N	NNW	NNW	NW	NW	NNW	NNE	NE	NE	N	N	NNE	N	NE	ENE	NE	NNE	N	NNE	NE	ENE	ENE	
14	E	ESE	E	ENE	E	E	E	ESE	ESE	ESE	ESE	ESE	V	N	N	N	N	N	N	NNE	NE	NE	NE	NE	
15	NE	ENE	NE	N	NNE	N	NNE	NE	E	SE	SE	ESE	ESE	ENE	NE	SE	SE	S	SE	SE	SE	SE	SE	SE	
16	ESE	ESE	ESE	ESE	ESE	E	E	ESE	SE	ESE	NE	NE	E	E	ENE	NE	ENE	E	N	N	NNE	ENE	ESE	SE	
17	SE	ESE	ESE	E	E	E	ENE	NE	NE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	N	N	N	N	N	N	N	
18	NE	N	ENE	NE	N	NNE	N	NE	C	C	C	W	V	NE	NE	NE	N	N	NE	NE	NNE	NNE	NNE	NNE	
19	NNE	NE	NE	NNE	NNE	NNE	NNE	NE	NE	ENE	NE	NE	NE	NE	NNE	NNE	NNE	NE	NE	NNE	NNE	NNE	NNE	NNE	
20	NNE	NE	NE	NE	NE	E	ESE	ESE	V	NE	NE	NE	NE	NE	NE	NNE	NE	NE	NNE	NNE	NE	NE	NE	ENE	
21	ENE	ENE	NE	NE	N	NE	SE	S	SSW	SSW	SW	SW	SSW	SSW	S	SSW	SSW	SSW	SSW	V	N	N	N	NNE	
22	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	ENE	ENE	ENE	ENE	NE	NE	NE	NE	NE	NE	NE	NNE	NNE	NNE	
23	NE	NNE	N	N	N	NE	C	V	SSE	SSW	S	SSW	SW	SW	SSW	SSW	SSW	SSW	SSW	SW	SSW	SW	C	SSE	
24	N	N	N	N	N	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	ENE	ENE	NE	NNE	NNE	NNE	
25	NE	NNE	NNE	NNE	NE	NE	NE	NE	NE	ENE	ENE	ENE	NE	NE	NNE	NE	NE	NE	NE	NE	NE	NE	NNE	NNE	
26	NE	NE	NE	NNE	NNE	NNE	NNE	NE	ENE	ENE	E	E	SE	N	N	N	N	N	N	NNE	NE	ENE	E	E	
27	E	ESE	ESE	E	E	E	ESE	SSE	S	SSW	SSW	SSW	SSW	SSW	SW	WSW	W	WNW	NW	N	V	SSW	WSW	WSW	
28	WSW	W	W	W	WSW	W	W	WSW	W	W	W	W	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	W	SW	SW	
29	WSW	WSW	WSW	WSW	SSW	S	S	SSW	SSW	SSW	S	SW	WSW	W	WNW	WNW	NW	NW	NW	NW	NW	NW	NW	NW	
30	NW	NW	NW	NW	NW	WNW	WNW	WNW	S	NW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	NW	WNW	WNW	WNW	W	W	W	

PERCENTAGE OF DATA VALID 99.9 **** - INSUFFICIENT DATA AVAILABLE

WIND VELOCITY AND DIRECTION DISTRIBUTION

DRECTION	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	V	C	NR
%FREQUENCY	14.3	11.1	20.3	5.8	3.8	4.2	3.2	1.5	2.9	4.7	7.9	4.9	4.2	4.6	2.9	0.8	1.5	1.3	0.1
AV. VELOCITY	14.6	14.0	18.6	15.7	11.9	11.1	12.2	10.8	13.6	14.7	18.5	14.5	15.4	20.4	22.6	12.2	6.5	0.2	

TABLE: F-24

OWMC AIR POLLUTION SURVEY

MET. DATA WIND DIRECTION-30m

UNITS PT. OF COMPASS

STATION LINCOLN COUNTY

MONTH MAY 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	W	WSW	W	W	W	W	W	W	W	WNW	WNW	W	WNW	WSW	SSW	SW	SW	SW	SW	SW	WSW	WSW	WSW	WSW	
2	SW	SW	SW	WSW	WSW	WSW	W	WSW	V	V	V	NE	NNE	NE	NE	NE	NE	NE	NE	NNE	NE	NE	NNE	N	
3	NNE	N	N	N	N	N	N	NNE	NE	NE	NNE	NNE	NE	NE	NE	NE	NE	ENE	ENE	ENE	ENE	NE	N	N	
4	NNE	NNE	NNE	NNE	NNE	NE	NNE	NE	NE	NE	NE	NE	NE	NE	NE	NE	ENE	ENE	NE	NE	ENE	N	N	N	
5	NNE	NNE	N	NNW	NNW	NNW	N	N	N	N	N	NNE	NNE	NNE	NNE	NNE	N	N	SE	WSW	WSW	WSW	W	W	
6	WNW	NNW	C	C	WSW	WSW	W	W	W	W	W	W	WSW	SSW	SW	SW	SW	SW	SW	SW	WSW	SW	SW	SW	
7	W	WNW	WNW	NW	WNW	NW	N	N	N	N	N	N	N	N	N	N	V	SW	SW	SSW	E	ENE	ENE	SSE	
8	N	N	N	NNW	NNW	NW	W	WSW	SSW	SW	V	V	SSW	SSW	SSW	SSW	SW	SW	SW	WNW	WSW	SW	WSW	WSW	
9	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	
10	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	W	W	V	NE	NE	V	V	
11	SSW	V	SE	V	V	SE	SSE	S	S	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	SW	SW	SW	
12	WSW	WNW	WNW	NW	NW	NNW	N	NNW	N	N	N	N	N	N	N	NNE	NNE	NNE	NNE	NE	NE	NE	ENE	NE	
13	NNE	NNE	NNE	NE	NE	NNE	NE	ENE	ESE	ESE	E	E	NE	N	N	N	N	NNE	NNE	NNE	NNE	NE	NE	SE	
14	S	S	S	S	S	S	SSE	S	S	SSW	SSW	SSW	SSW	SSW	SW	SSW	SSW	SSW	SW	SSW	****	****	****	****	
15	****	****	****	****	****	****	****	****	****	****	****	N	N	NNW	NNW	N	N	N	NNE	N	NNE	N	N	N	
16	NNE	C	NW	NNW	NNW	NNW	C	C	SSW	SW	SW	SW	SW	SSW	SW	SW	SW	SW	SW	SW	SW	SW	SSW	SSW	
17	SW	SW	SW	WSW	SSW	SSW	SSW	SW	SW	WSW	SW	SSW	SW	SSW	SSW	SW	SW	SW	SW	SW	SW	SSW	S	SSW	
18	SW	WNW	WNW	NW	NW	N	NNE	NE	NNE	NNE	NE	NE	ENE	NE	NE	NE	NE	NE	NE	NE	ENE	ENE	ENE	NE	
19	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	ENE	NE	NE	NE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	SE	SE	
20	SE	SE	SE	SSE	SE	SE	SE	SSE	SSE	SSE	SSE	SSE	SSE	SE	SE	SE	SE	SE	NE	NE	ESE	SSE	SSE	S	
21	S	S	SSW	SSE	SSE	S	SSE	SSE	SSE	S	S	SSE	SE	SSE	S	SSW	SSW	V	NNE	NE	ENE	ESE	S	S	
22	S	S	S	S	SSW	SSW	SSW	SSW	SW	SW	SSW	SW	SW	WSW	WSW	W	SW	SW	SW	SW	S	SSW	S	SSW	
23	SSW	SSW	SW	WSW	WSW	W	W	W	SW	SW	SW	WSW	W	SW	WSW	WNW	W	WNW	WNW	NW	NNW	NW	NW	WNW	
24	NW	WNW	WNW	WNW	WNW	WNW	WNW	NNW	NNW	N	N	N	WNW	V	W	W	WNW	WNW	E	NW	NE	NE	C	C	
25	NE	C	E	ENE	NE	NNE	NE	NE	NE	NE	NE	NE	NE	NNE	NNE	NNE	NNE	NNE	NNE	NE	NNE	N	NNE	NE	
26	NNE	NNE	NNE	NNE	NNE	N	NNE	C	NNE	NNE	NE	NE	NE	ENE	V	S	V	NE	ENE	C	SSE	S	SW	SSW	
27	SW	SW	SW	SSW	SSW	SSW	SW	SW	SW	SW	SW	SW	SSW	SW	SW	SSW	SW	SSW	SSW	SSW	SSW	SSW	SW	SW	
28	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SSW	SSW	SSW	SW	SW	SW	SW	SW	SW	SW	WSW	WSW	WSW	
29	WSW	WSW	WSW	SW	SW	SW	SW	SW	WSW	WSW	WSW	W	W	WSW	SSW	SW	SW	SW	SW	SW	SW	SW	WSW	WSW	
30	SW	SSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SSW	SSW	SSW	SSW	SW	SW	SW	SW	SSW	SSW	SW	WSW	WSW	
31	WSW	SW	SSW	SSW	SW	SW	WSW	WSW	WSW	SSW	SW	SW	WSW	SW	SSW	SSW	SW	SW	SW	SW	SW	SW	SSW	SSW	

PERCENTAGE OF DATA VALID 98.0

**** - INSUFFICIENT DATA AVAILABLE

WIND VELOCITY AND DIRECTION DISTRIBUTION

DRECTION	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	V	C	NR
XFREQUENCY	8.1	7.5	11.6	3.6	0.7	0.5	2.4	2.7	3.8	9.5	25.8	6.7	4.3	3.4	1.7	2.2	2.2	1.3	2.0
AV. VELOCITY	12.7	11.5	14.3	15.4	8.6	12.5	10.5	11.7	12.1	15.4	18.8	13.7	12.7	11.5	9.0	8.9	7.4	0.7	

TABLE: F-25 OWMC AIR POLLUTION SURVEY

MET. DATA WIND SPEED-10m UNITS KM/HR

STATION LINCOLN COUNTY MONTH JUN 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	3	3	3	3	4	6	10	18	23	25	29	30	33	29	18	18	20	23	24	19	19	20	25	26	18.0
2	18	14	14	19	19	23	25	24	20	18	20	16	14	15	****	****	12	10	9	7	6	3	7	4	14.4
3	1	0	1	0	0	0	0	1	4	4	9	11	12	11	11	10	8	6	4	5	3	1	0	1	4.3
4	0	3	6	7	4	3	2	5	13	13	13	14	15	17	19	19	****	****	****	****	****	****	****	****	9.6
5	2	2	2	3	5	3	2	5	4	5	8	6	****	****	****	****	****	****	****	****	****	****	****	****	3.9
6	****	****	****	****	****	****	****	****	13	13	13	14	16	15	15	14	13	10	12	12	10	9	9	7	12.2
7	6	6	7	6	6	6	4	3	2	2	2	2	1	2	3	8	11	12	12	8	7	3	2	4	5.2
8	6	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
9	****	****	****	****	****	****	****	****	10	9	11	12	10	8	4	6	4	6	6	6	5	3	1	1	6.4
10	0	1	2	2	2	1	3	3	4	4	8	8	6	6	5	6	7	8	4	3	2	5	4	6	4.2
11	12	16	19	14	10	8	12	10	5	6	7	5	12	8	11	11	7	8	12	10	9	9	9	9	10.0
12	11	12	12	7	6	3	4	2	2	5	3	2	2	8	16	10	****	****	****	****	****	****	****	****	6.6
13	DATA MISSING																								
14	****	****	****	****	****	****	****	****	****	****	****	****	3	3	3	4	6	5	3	1	3	5	5	3	3.7
15	1	3	1	1	1	2	3	3	3	3	4	9	8	7	3	4	3	4	4	2	4	6	6	4	3.7
16	12	16	11	5	6	12	16	17	24	29	30	35	34	34	36	35	****	****	18	25	19	18	18	13	21.0
17	7	5	5	6	7	7	5	12	16	17	16	13	11	9	13	13	15	15	17	15	10	8	5	7	10.6
18	5	2	6	6	4	7	6	9	11	12	11	11	12	13	18	****	****	****	****	****	****	****	****	****	8.9
19	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	14	13	11	10	4	4	****
20	5	5	7	7	4	5	11	14	13	13	14	13	12	****	11	13	13	9	7	4	1	0	0	0	7.9
21	1	4	5	2	0	0	0	1	2	2	3	5	5	6	8	8	8	9	8	6	3	1	0	2	3.7
22	0	3	3	3	5	6	7	7	9	12	16	19	20	19	18	18	17	18	16	14	14	15	16	6	11.7
23	10	11	12	11	9	7	7	9	9	10	13	17	19	18	21	24	21	21	20	15	13	11	9	11	13.7
24	11	10	10	8	7	16	8	14	18	18	18	20	23	23	21	20	20	18	18	13	11	10	9	9	14.7
25	6	6	5	6	6	6	7	5	6	7	9	7	9	12	10	****	****	****	****	****	****	****	****	****	7.1
26	DATA MISSING																								
27	****	****	****	****	****	****	****	****	****	****	****	****	15	17	17	16	18	12	14	9	6	3	4	2	11.1
28	3	3	3	1	0	1	2	1	1	2	4	7	10	15	15	18	17	16	12	10	9	8	5	6	7.0
29	7	9	6	5	3	5	7	8	9	11	13	18	21	19	24	22	19	7	6	2	3	3	4	3	9.8
30	5	5	4	3	4	0	2	4	6	6	5	4	3	6	6	5	9	10	9	7	5	4	0	0	4.7
MEAN	5.7	6.3	6.5	5.7	5.1	5.8	6.5	8.0	9.5	10.3	11.6	12.4	13.0	13.3	13.6	13.7	12.4	11.4	11.3	9.4	7.9	7.0	6.5	5.8	9.2

PERCENTAGE OF DATA VALID 75.0 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 4949.00 TOTAL MONTHLY RECORD HOURS = 540.00

TABLE: F-26 OWMC AIR POLLUTION SURVEY

MET. DATA WIND SPEED-10m UNITS KM/HR

STATION LINCOLN COUNTY MONTH JUL 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	1	0	0	0	2	7	9	12	9	10	8	6	6	7	6	5	2	1	4	3	4	4.3
2	4	3	9	7	6	7	7	6	6	6	6	9	10	11	10	8	6	6	6	3	5	11	7	9	7.0
3	9	14	13	10	8	7	8	12	12	12	13	14	14	13	12	12	12	11	9	9	4	0	0	1	9.5
4	0	0	0	0	1	3	1	5	13	15	21	23	25	27	28	19	17	22	24	24	24	25	25	26	15.3
5	21	19	15	14	13	14	12	15	17	21	22	20	20	16	22	21	17	17	15	16	15	11	10	9	16.3
6	9	10	8	6	2	3	3	8	13	15	15	16	18	19	20	19	22	23	20	13	9	10	8	9	12.4
7	8	8	9	7	5	4	2	5	6	5	6	7	14	15	8	10	7	5	10	10	7	8	5	5	7.3
8	5	2	2	3	3	3	3	6	8	10	12	11	12	11	10	10	11	10	7	10	6	3	3	5	6.9
9	3	0	2	4	4	5	5	6	6	5	5	5	6	9	9	10	10	12	9	11	9	7	5	7	6.4
10	7	9	8	7	5	1	5	6	9	7	4	5	6	8	6	4	9	8	8	4	1	1	1	4	5.5
11	5	5	5	3	2	2	2	5	8	10	11	7	8	6	5	6	4	6	7	6	5	6	6	7	5.7
12	8	9	8	11	8	8	6	6	8	6	8	8	10	9	8	8	7	7	5	9	8	8	9	6	7.8
13	10	6	5	8	6	5	2	3	2	6	14	14	20	21	23	19	23	25	18	14	15	9	9	6	11.8
14	1	8	9	10	10	8	6	9	11	19	22	19	15	16	15	12	10	7	8	4	4	6	5	9	10.1
15	2	3	4	4	3	4	5	6	4	5	4	7	7	8	9	12	12	12	11	8	5	2	0	3	5.8
16	1	0	3	3	4	4	7	7	9	4	3	3	9	12	11	11	10	9	4	4	4	3	2	0	5.3
17	1	0	0	1	0	3	1	0	3	4	10	7	13	15	13	9	9	9	9	6	3	6	5	0	5.3
18	3	11	7	5	2	6	4	4	7	6	6	7	6	10	10	15	20	18	9	12	3	8	9	13	8.4
19	2	4	4	7	8	7	4	5	7	6	2	2	3	1	3	5	8	8	7	5	5	5	4	3	4.8
20	3	3	3	4	4	1	3	3	6	7	7	5	3	5	6	8	14	13	10	7	8	5	7	10	6.0
21	11	8	9	10	8	8	8	8	10	12	10	9	8	8	6	7	7	6	7	6	5	2	2	0	7.3
22	0	0	0	0	0	1	0	1	2	2	2	2	4	4	6	5	4	6	8	6	3	2	1	4	2.6
23	4	1	0	1	0	1	1	0	4	4	4	4	2	5	9	8	8	6	5	2	0	0	0	0	2.9
24	1	0	0	0	1	2	4	2	3	8	8	8	8	9	11	12	12	11	6	6	5	5	6	3	5.5
25	5	6	6	5	7	6	6	7	12	16	18	20	20	18	19	21	11	6	3	6	5	5	6	12	10.3
26	7	8	7	11	13	10	10	7	8	11	13	10	10	8	8	9	11	8	9	8	6	7	4	4	8.6
27	4	4	6	9	9	4	2	3	6	5	7	9	9	9	8	8	7	7	4	2	3	1	1	0	5.3
28	0	1	0	0	1	0	1	1	5	7	10	9	10	11	10	10	11	13	10	6	6	2	3	6	5.5
29	4	6	7	9	10	10	10	11	14	13	15	12	12	12	9	11	16	18	17	16	15	11	11	12	11.7
30	11	11	12	11	12	10	9	8	9	10	9	9	10	11	8	8	9	9	7	4	4	3	4	2	8.3
31	4	4	3	1	3	1	0	0	11	5	4	4	5	3	1	3	7	13	11	4	0	1	0	2	3.8
MEAN	4.9	5.3	5.3	5.5	5.1	4.8	4.4	5.4	7.9	8.7	9.8	9.5	10.5	10.9	10.6	10.5	10.9	10.9	9.3	7.8	6.2	5.7	5.2	5.8	7.5

PERCENTAGE OF DATA VALID 100.0 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 5614.00 TOTAL MONTHLY RECORD HOURS = 744.00

TABLE: F-27

OWMC AIR POLLUTION SURVEY

MET. DATA WIND SPEED-10m

UNITS KM/HR

STATION LINCOLN COUNTY

MONTH AUG 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	4	4	4	4	4	4	2	5	8	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
2											DATA MISSING														
3											DATA MISSING														
4											DATA MISSING														
5											DATA MISSING														
6	1	1	0	0	0	0	0	0	0	1	1	3	5	5	5	5	3	1	1	5	7	7	7	5	2.6
7	2	5	2	5	5	5	5	5	5	3	3	5	7	9	10	9	7	7	3	1	1	0	0	1	4.4
8	3	3	3	1	1	5	5	7	9	10	14	12	13	13	14	13	15	14	12	9	10	7	6	3	8.4
9	7	7	9	5	9	14	16	14	16	16	16	14	14	14	14	10	10	5	3	5	3	3	3	1	9.5
10	0	0	0	1	1	1	3	9	9	9	10	9	5	3	5	5	5	9	10	7	9	9	9	10	5.8
11	7	7	7	10	10	16	18	18	18	18	18	18	18	20	14	18	17	17	13	8	6	5	4	5	12.9
12	3	2	0	2	0	0	2	0	6	9	8	8	5	7	4	4	10	8	7	5	3	1	0	0	3.9
13	0	0	0	2	2	0	0	0	2	5	7	7	7	5	3	7	11	11	10	9	7	4	2	6	4.5
14	6	5	3	3	4	2	3	5	6	9	10	9	7	6	7	11	8	6	5	5	7	10	10	9	6.5
15	9	11	11	9	9	8	6	3	8	13	16	20	22	22	24	25	21	19	17	3	8	6	6	6	12.6
16	5	5	7	9	8	7	5	6	7	6	7	8	9	12	14	15	14	9	7	5	3	4	3	3	7.4
17	3	3	2	1	0	1	0	0	4	4	4	3	4	5	7	6	7	10	6	1	0	0	0	3	3.1
18	4	3	5	8	5	5	8	10	13	13	14	14	13	14	15	14	13	12	10	4	2	11	21	44	11.5
19	32	33	29	24	23	23	21	21	20	21	23	23	24	19	15	15	13	12	10	7	4	5	3	6	17.8
20	3	5	5	3	5	5	5	5	9	9	9	9	9	9	7	9	10	10	9	7	3	3	1	0	6.2
21	3	3	0	0	1	5	3	3	7	9	9	7	5	7	5	3	3	3	1	0	0	3	7	5	3.8
22	3	9	10	10	5	0	0	0	1	1	0	0	0	1	0	1	3	1	0	0	0	0	0	0	1.9
23	0	0	0	0	0	0	0	0	1	12	14	18	18	18	16	16	16	16	20	21	21	14	9	12	10.1
24	12	10	10	10	9	10	10	9	10	14	16	16	18	18	18	18	16	14	12	7	3	5	7	3	11.5
25	3	3	3	3	3	1	3	3	3	5	5	9	10	10	12	14	10	10	9	7	7	5	1	1	5.8
26	1	1	1	5	3	3	5	1	5	10	14	14	16	18	18	14	9	9	9	9	12	14	14	18	9.3
27	21	29	21	16	14	18	18	14	10	14	14	14	14	12	16	18	18	18	18	10	9	9	9	9	15.1
28	5	5	5	7	7	5	3	3	3	7	10	9	9	10	12	13	12	13	16	16	16	13	10	5	8.9
29	7	7	3	5	6	5	4	4	7	13	15	14	10	7	7	13	14	14	13	9	7	4	3	1	8.0
30	0	1	2	1	0	1	3	0	2	7	11	11	13	15	15	14	12	12	7	4	1	0	1	1	5.6
31	0	2	0	1	0	0	0	2	4	6	7	6	6	6	5	5	6	11	9	7	6	5	5	5	4.3
MEAN	5.3	6.1	5.3	5.4	5.0	5.3	5.5	5.4	7.1	9.4	10.6	10.8	10.8	11.0	10.8	11.3	10.9	10.4	9.1	6.6	6.0	5.7	5.4	6.2	7.7

PERCENTAGE OF DATA VALID 85.1

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 4870.00 TOTAL MONTHLY RECORD HOURS = 633.00

TABLE: F-28 OWMC AIR POLLUTION SURVEY

MET. DATA WIND SPEED-10m UNITS KM/HR

STATION LINCOLN COUNTY MONTH SEP 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	4	1	1	1	0	1	0	1	3	4	3	3	4	6	8	9	6	8	6	2	2	0	1	3	3.2
2	2	1	0	1	0	0	0	0	1	3	3	4	4	5	7	5	7	7	6	4	2	3	3	6	3.1
3	6	4	2	2	2	2	1	1	3	2	3	5	6	5	5	7	10	9	5	2	7	9	6	2	4.4
4	2	5	5	7	6	8	10	12	13	13	17	15	16	13	11	9	11	9	8	12	12	11	12	13	10.4
5	15	10	6	4	5	7	7	8	8	11	16	21	21	19	16	16	17	15	13	9	5	3	3	7	10.9
6	7	7	6	7	6	6	4	4	7	10	11	13	13	15	15	13	11	9	9	7	3	3	4	7	8.2
7	12	7	1	1	2	2	4	3	4	7	12	14	17	15	17	17	17	16	12	7	7	6	6	3	8.7
8	3	0	0	0	0	0	0	0	6	9	14	17	17	20	22	21	19	18	18	13	10	8	8	8	9.6
9	7	5	5	5	4	3	1	1	5	8	13	15	14	16	17	19	18	15	7	1	0	2	1	2	7.7
10	2	2	3	5	4	4	5	7	10	14	12	14	7	10	7	9	5	5	5	5	6	21	24	27	8.9
11	28	25	29	25	14	10	16	21	22	22	23	24	26	21	16	13	19	15	20	23	25	27	28	24	21.5
12	17	19	19	19	28	29	23	22	25	25	23	23	23	25	23	23	21	21	13	8	6	4	2	5	18.6
13	4	3	2	0	0	3	5	8	14	16	14	16	17	16	21	21	21	20	17	13	9	8	8	7	11.0
14	2	3	3	1	3	4	4	2	3	2	4	8	7	8	10	11	14	12	9	6	1	3	3	1	5.2
15	3	4	4	3	0	1	2	1	1	0	2	6	7	10	12	12	10	8	6	13	22	17	18	17	7.5
16	7	6	3	3	2	3	4	4	5	9	12	10	11	9	9	10	8	10	6	2	3	2	4	4	6.1
17	4	4	6	2	1	2	0	1	1	5	6	8	6	4	6	6	10	10	8	7	7	6	4	4	4.9
18	4	3	5	6	4	5	5	4	5	7	9	8	9	13	10	8	7	6	5	2	0	0	0	0	5.2
19	0	0	1	3	4	5	7	7	5	5	7	9	8	6	6	6	5	4	2	3	2	4	4	4	4.5
20	5	4	6	4	5	5	4	1	4	5	6	8	8	6	6	7	5	6	5	6	8	8	10	8	5.8
21	7	10	9	6	8	7	7	7	8	11	13	13	11	9	7	7	8	9	8	7	7	7	6	6	8.3
22	5	4	4	5	5	4	2	2	4	4	3	13	15	8	10	14	12	11	9	5	2	3	2	3	6.2
23	2	10	8	4	5	5	10	10	7	6	8	9	17	14	9	9	15	12	8	6	5	3	4	2	7.8
24	0	0	0	0	0	0	0	0	0	3	10	12	11	14	11	11	11	9	5	3	3	2	0	0	4.4
25	0	0	0	0	0	0	0	1	2	3	3	2	2	6	6	5	4	4	2	4	5	6	6	3	2.7
26	1	0	1	4	4	2	2	2	2	6	9	12	14	9	10	7	7	7	7	6	4	2	6	7	5.5
27	8	14	17	16	14	10	7	17	15	7	8	12	14	9	6	5	7	9	6	6	6	5	6	6	9.6
28	4	3	2	2	3	2	2	0	0	1	4	4	1	7	9	9	9	6	0	2	5	2	4	1	3.4
29	3	3	4	4	6	10	17	4	8	6	7	4	4	4	6	10	13	10	7	5	8	24	24	25	9.0
30	27	28	29	27	24	19	14	12	10	11	13	12	11	9	9	6	4	9	6	8	9	9	11	9	13.6
MEAN	6.4	6.2	6.0	5.6	5.3	5.3	5.4	5.4	6.7	7.8	9.6	11.1	11.4	11.0	10.9	10.8	11.0	10.3	7.9	6.6	6.4	6.9	7.3	7.1	7.9

PERCENTAGE OF DATA VALID 100.0 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 5656.00 TOTAL MONTHLY RECORD HOURS = 720.00

TABLE: F-29

OWMC AIR POLLUTION SURVEY

MET. DATA WIND SPEED-10m

UNITS KM/HR

STATION LINCOLN COUNTY

MONTH OCT 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	10	9	5	1	2	2	1	0	1	4	5	3	1	1	1	4	7	8	6	6	7	7	7	10	4.5
2	13	9	10	8	7	8	9	7	6	5	7	5	5	4	3	2	2	4	5	3	1	0	0	1	5.2
3	1	3	4	3	4	5	5	3	5	6	11	12	14	14	18	19	18	11	6	7	8	5	6	7	8.1
4	7	8	7	6	5	4	4	3	9	8	9	10	9	12	20	17	12	11	7	6	6	5	7	8	8.3
5	6	5	7	5	7	3	5	0	5	9	10	10	11	14	5	8	12	13	8	14	7	13	17	8	8.4
6	16	16	19	18	21	21	22	18	19	26	21	17	15	17	17	15	17	14	11	11	10	4	1	3	15.4
7	5	3	1	0	0	2	4	4	3	8	13	17	20	22	21	23	25	24	17	15	14	16	16	17	12.1
8	19	22	22	19	22	21	23	21	21	23	25	24	21	22	26	23	17	10	8	10	12	11	15	12	18.7
9	11	10	6	12	15	16	16	16	15	20	23	21	18	18	14	14	12	11	7	5	4	6	4	4	12.4
10	3	4	3	10	8	8	8	6	8	13	13	13	13	13	14	15	15	12	8	7	9	9	11	10	9.7
11	7	6	4	4	3	3	4	3	6	12	13	13	11	10	10	11	11	4	2	3	2	6	8	9	6.9
12	8	7	8	8	6	7	7	7	8	13	11	13	11	8	6	5	14	3	4	3	3	5	5	6	7.3
13	9	10	7	10	8	7	8	7	8	8	8	10	12	7	12	13	10	9	5	5	2	1	2	5	7.6
14	6	8	10	10	15	17	19	17	21	22	21	20	18	17	17	19	23	25	18	14	19	22	25	17	17.5
15	20	16	14	17	15	12	14	12	14	18	19	19	18	18	15	16	15	15	11	14	12	9	5	3	14.2
16	4	4	1	4	2	3	4	3	4	8	9	8	6	7	4	5	6	8	4	2	0	0	0	2	4.1
17	2	2	2	3	3	3	6	7	6	5	6	8	12	12	15	14	12	9	6	5	4	4	4	4	6.4
18	5	4	3	3	1	3	5	5	4	4	4	5	6	5	4	2	3	3	3	2	0	0	0	0	3.1
19	0	0	0	0	0	0	1	4	4	4	6	10	7	7	8	9	12	11	8	6	5	5	5	3	4.8
20	5	6	6	2	1	2	4	4	5	8	9	12	13	15	18	20	19	16	14	11	9	7	6	7	9.1
21	5	4	5	8	11	10	13	11	12	10	13	12	10	10	11	9	7	7	3	3	1	2	3	0	7.5
22	1	0	2	2	2	1	2	3	5	10	10	13	13	14	15	16	14	11	12	10	9	7	7	7	7.8
23	9	10	9	10	9	10	8	7	10	12	13	15	15	13	12	6	6	4	6	9	10	9	9	15	9.8
24	4	3	6	5	6	1	4	6	5	8	10	11	12	13	11	12	11	8	6	6	9	8	8	6	7.5
25	7	7	5	6	6	6	5	3	4	6	6	5	4	4	7	8	7	5	6	5	6	6	5	4	5.5
26	2	3	3	2	4	4	5	4	5	5	6	7	8	7	8	8	7	7	6	4	5	5	4	1	5.0
27	0	0	1	0	1	3	1	3	3	10	11	13	15	13	9	11	10	8	10	9	9	9	9	9	7.0
28	9	8	6	3	8	3	2	1	7	8	13	14	15	16	19	21	18	13	11	9	8	12	14	16	10.6
29	18	16	19	21	21	21	19	11	19	23	25	27	23	24	21	14	14	14	15	14	16	10	9	12	17.8
30	9	7	10	9	8	7	8	4	8	10	11	12	11	9	8	7	5	3	1	0	2	1	0	1	6.3
31	3	6	5	4	7	4	7	5	9	7	8	9	10	9	9	7	5	3	4	9	13	13	15	16	7.8
MEAN	7.2	7.0	6.8	6.9	7.4	7.0	7.8	6.6	8.4	10.7	11.9	12.5	12.2	12.1	12.2	12.0	11.8	9.8	7.7	7.3	7.2	7.0	7.3	7.2	8.9

PERCENTAGE OF DATA VALID 100.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 6632.00 TOTAL MONTHLY RECORD HOURS = 744.00

TABLE: F-30 OWMC AIR POLLUTION SURVEY

MET. DATA WIND SPEED-10m UNITS KM/HR

STATION LINCOLN COUNTY MONTH NOV 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	17	18	19	14	14	17	16	16	18	20	25	24	27	28	25	24	16	9	10	10	8	7	7	4	16.4
2	6	11	7	5	1	4	6	6	6	9	13	13	11	12	12	8	8	5	6	6	6	3	0	.0	6.8
3	2	0	0	1	4	3	3	2	0	1	5	15	21	22	21	19	17	17	18	15	16	10	15	17	10.2
4	12	13	14	13	11	14	10	6	10	13	11	13	12	12	11	11	8	5	4	5	7	7	8	6	9.8
5	6	6	6	6	7	8	8	7	9	11	11	11	10	9	10	8	6	8	8	6	2	1	2	1	7.0
6	1	0	1	1	0	0	1	1	4	6	5	9	10	10	11	11	8	5	3	1	1	0	3	3	4.0
7	5	5	5	5	5	4	3	4	4	5	4	1	2	6	8	7	6	5	4	4	5	1	2	1	4.2
8	3	4	4	5	6	5	7	7	11	11	14	12	11	15	21	23	19	17	16	15	10	12	18	11	11.5
9	14	9	8	11	14	18	17	18	22	27	32	34	34	36	35	36	33	29	32	31	29	26	23	19	24.5
10	15	16	14	13	11	14	17	17	17	16	16	14	12	12	9	7	4	3	2	0	2	3	3	1	9.9
11	3	2	1	3	5	0	1	3	2	0	2	0	1	7	9	9	8	6	7	6	7	6	10	9	4.5
12	2	1	2	3	4	6	5	7	8	10	7	7	****	12	13	14	11	17	18	22	25	24	18	20	11.1
13	24	20	20	20	18	17	15	12	13	13	12	11	15	16	16	16	16	18	15	18	17	13	13	10	15.8
14	10	11	10	8	8	10	11	10	9	8	10	13	27	28	27	24	18	18	19	21	23	23	25	22	16.4
15	19	13	7	9	8	5	6	7	10	11	12	14	11	7	16	15	16	14	14	15	15	13	13	7	11.5
16	4	4	5	6	7	4	3	3	4	3	3	2	2	5	1	1	1	1	1	5	5	7	9	6	3.8
17	7	7	6	2	1	8	14	12	14	14	19	25	26	25	25	20	13	7	4	5	6	3	3	2	11.2
18	4	3	3	2	2	2	4	6	6	6	10	13	12	13	16	18	22	23	20	20	17	16	16	15	11.2
19	14	13	15	15	15	11	10	10	13	14	15	9	8	7	6	8	7	7	8	9	9	8	11	11	10.5
20	12	12	13	12	11	10	8	8	11	14	11	12	10	9	9	9	9	6	5	7	5	5	3	4	9.0
21	10	10	10	11	13	14	10	9	10	13	16	13	12	14	11	13	9	7	6	5	7	7	8	6	10.2
22	5	4	4	3	0	1	1	1	1	4	5	4	4	9	10	8	6	4	5	7	6	5	5	6	4.5
23	6	3	4	4	6	9	9	8	9	10	13	15	15	12	10	12	12	11	19	23	23	23	22	18	12.3
24	19	19	21	22	17	13	18	16	18	18	20	20	21	21	20	15	13	11	10	5	7	11	9	7	15.5
25	5	8	11	8	7	8	6	7	9	16	16	13	14	13	11	8	6	4	5	3	4	3	4	6	8.1
26	6	5	4	5	3	2	5	7	6	8	10	13	11	12	15	17	20	19	17	15	9	11	10	9	10.0
27	8	7	6	6	6	5	3	4	5	4	4	9	16	18	17	12	14	13	12	12	15	16	21	21	10.6
28	23	24	16	16	14	13	13	14	13	12	18	22	23	24	22	22	20	15	11	12	8	7	9	11	15.9
29	11	13	15	9	9	10	8	6	10	9	11	14	14	13	12	7	6	6	5	5	4	3	6	8	8.9
30	8	8	6	8	6	6	7	6	8	13	16	17	16	17	17	18	15	17	17	16	13	9	8	9	11.7
MEAN	9.4	9.0	8.6	8.2	7.8	8.0	8.2	8.0	9.3	10.6	12.2	13.1	14.1	14.8	14.9	14.0	12.2	10.9	10.7	10.8	10.4	9.4	10.1	9.0	10.6

PERCENTAGE OF DATA VALID 99.9 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 7594.00 TOTAL MONTHLY RECORD HOURS = 719.00

TABLE: F-31

OWMC AIR POLLUTION SURVEY

MET. DATA WIND SPEED-10m

UNITS KM/HR

STATION LINCOLN COUNTY

MONTH DEC 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	11	12	17	15	16	16	18	16	22	22	18	19	19	18	18	18	18	18	18	18	18	18	16	16	17.3
2	15	13	10	11	14	14	16	10	8	7	9	8	7	8	10	10	9	8	11	10	10	10	9	7	10.2
3	7	6	3	1	1	3	5	5	12	15	18	23	23	26	26	20	32	26	26	31	29	32	28	24	17.6
4	34	36	34	32	27	30	28	25	30	30	29	31	30	31	30	22	22	20	20	22	24	25	25	27	27.7
5	24	24	23	22	23	21	21	18	18	18	18	16	13	15	16	15	11	10	9	9	7	7	5	7	15.4
6	22	25	27	27	27	28	27	29	28	28	26	20	20	17	15	15	13	13	10	6	5	2	3	1	18.1
7	0	1	1	1	4	5	6	7	13	18	23	26	28	28	25	25	22	16	14	12	10	9	8	7	12.9
8	7	5	6	7	16	15	15	17	19	20	22	20	22	20	22	20	21	22	19	16	17	17	15	13	16.4
9	12	9	6	7	7	5	4	5	3	2	3	2	3	4	6	5	6	12	7	10	10	14	17	15	7.3
10	11	17	18	15	15	16	26	33	33	32	32	35	33	31	28	31	24	21	17	15	15	18	15	14	22.7
11	16	16	14	10	9	6	5	2	2	5	15	16	17	19	18	13	10	11	10	16	19	23	22	21	13.1
12	23	23	24	25	21	17	16	19	16	14	16	20	20	20	19	18	17	16	14	16	18	17	15	14	18.3
13	11	14	10	9	6	6	7	5	7	9	11	9	11	10	10	9	10	6	2	2	2	3	4	6	7.5
14	16	19	20	21	21	23	19	19	25	28	29	28	30	31	29	30	26	23	31	32	30	20	19	17	24.4
15	15	15	13	12	10	8	8	7	6	9	10	9	13	9	6	3	6	5	4	3	2	1	3	9	7.8
16	8	9	8	9	8	4	4	2	0	3	1	0	0	2	2	4	4	4	5	3	5	4	3	3	4.0
17	0	1	2	2	2	3	3	4	5	3	3	5	7	8	8	5	3	3	2	3	6	9	7	6	4.2
18	6	7	8	9	8	9	5	8	9	14	19	22	18	19	18	16	15	14	13	12	13	10	12	10	12.3
19	10	9	11	14	15	15	15	18	16	14	14	10	10	10	10	8	6	6	7	10	8	8	8	6	10.8
20	5	6	7	8	6	3	4	3	4	5	8	9	7	6	4	3	3	4	4	2	5	2	2	2	4.7
21	3	4	5	5	4	3	3	4	4	7	8	6	4	5	7	12	8	5	5	4	6	6	4	9	5.5
22	11	10	9	9	9	10	10	11	13	16	21	20	24	26	26	23	24	21	22	25	24	25	26	26	18.4
23	25	28	31	28	24	22	21	18	17	14	14	14	12	9	10	8	6	4	3	4	4	2	1	2	13.4
24	4	7	11	9	10	11	11	14	15	16	16	15	15	15	18	15	18	17	17	16	15	15	10	11	13.4
25	16	14	6	5	2	0	2	6	10	15	15	15	17	19	18	11	15	14	15	15	14	13	11	8	11.5
26	8	7	7	7	7	7	9	8	9	10	12	14	14	13	10	10	8	8	3	1	3	4	3	5	7.8
27	5	4	2	1	3	2	4	3	2	1	2	1	1	3	3	3	3	2	1	3	2	1	2	2	2.3
28	2	3	3	4	7	7	8	8	5	7	9	12	18	17	16	15	15	17	14	17	10	8	7	7	9.8
29	5	6	8	10	12	9	9	12	9	9	13	14	14	12	8	6	2	1	1	2	2	2	3	4	7.2
30	4	2	0	0	5	5	2	4	5	6	8	8	9	8	8	7	7	7	5	6	6	7	7	8	5.6
31	8	7	6	5	5	3	3	3	4	4	3	4	5	5	7	6	6	7	6	4	4	6	6	6	5.1
MEAN	11.1	11.6	11.3	11.0	11.1	10.5	10.8	11.1	11.9	12.9	14.4	14.5	15.0	15.0	14.5	13.1	12.6	11.6	10.8	11.1	11.1	10.9	10.2	10.1	12.0

PERCENTAGE OF DATA VALID 100.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 8932.00 TOTAL MONTHLY RECORD HOURS = 744.00

TABLE: F-32 OWMC AIR POLLUTION SURVEY

MET. DATA WIND SPEED-10m UNITS KM/HR

STATION LINCOLN COUNTY MONTH JAN 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	5	3	6	6	4	7	4	6	6	5	5	3	2	4	3	4	7	8	8	7	7	8	8	7	5.5
2	6	7	9	13	13	13	14	9	9	10	11	8	13	10	12	8	8	8	7	8	10	12	12	10	10.0
3	8	9	10	12	12	12	10	10	11	8	9	9	8	10	12	9	7	7	6	9	7	5	3	2	8.5
4	2	4	6	5	6	5	4	2	1	2	2	2	2	2	4	6	4	1	2	2	2	4	1	2	3.0
5	1	2	3	3	2	1	2	2	3	3	2	3	4	4	3	4	4	3	2	1	1	2	3	4	2.6
6	4	4	5	6	5	4	4	4	4	5	4	8	9	7	5	6	7	5	8	9	16	20	23	21	8.0
7	17	17	15	17	18	18	22	22	20	20	21	18	18	17	14	13	19	16	16	14	13	17	13	14	17.0
8	17	12	12	10	6	4	4	5	5	13	15	14	14	17	11	12	12	10	14	16	12	14	16	19	11.8
9	18	21	16	16	12	13	12	15	12	11	11	7	6	7	5	9	6	2	2	2	6	10	10	13	10.1
10	14	13	11	9	11	11	8	6	4	5	4	4	3	5	6	9	9	7	7	9	11	8	7	8	7.9
11	8	7	6	7	11	10	11	13	14	18	19	17	17	18	22	23	20	20	20	23	26	26	26	27	17.0
12	28	24	23	24	23	23	22	20	21	22	24	21	21	20	15	16	16	11	11	11	15	14	16	15	19.0
13	11	9	13	13	11	16	11	7	8	10	18	19	16	17	18	15	9	9	7	6	6	7	7	8	11.3
14	8	13	14	15	20	25	24	24	21	21	23	22	22	21	17	18	18	18	17	16	17	18	18	18	18.7
15	16	17	16	19	16	14	15	13	11	14	15	17	22	22	20	18	18	18	16	12	10	9	12	16	15.7
16	14	11	12	10	13	12	13	8	7	8	9	11	5	6	5	6	5	2	1	2	5	6	6	5	7.6
17	5	7	8	7	5	6	7	8	11	11	13	15	14	13	14	14	16	14	14	12	14	13	10	8	10.8
18	8	7	6	7	3	3	4	5	8	11	10	14	14	11	10	10	10	8	8	8	5	3	3	4	7.5
19	3	3	3	1	3	4	5	8	10	14	20	24	28	27	33	29	22	26	26	26	21	16	14	10	15.7
20	7	9	10	8	6	6	5	4	3	4	3	4	8	11	13	10	17	16	16	19	15	17	22	26	10.8
21	25	23	23	20	19	20	21	16	14	15	13	17	15	18	19	20	15	12	9	8	10	6	10	16	16.0
22	12	10	11	10	11	10	10	9	11	6	10	10	11	10	6	5	7	5	5	4	2	0	0	0	7.3
23	4	9	5	7	18	28	24	24	26	26	31	35	34	36	36	37	24	22	19	26	23	24	28	29	24.0
24	27	29	28	29	28	27	25	26	25	28	29	31	33	31	30	28	26	19	21	20	21	20	19	19	25.8
25	20	17	13	12	12	11	10	10	11	12	14	14	12	10	7	5	3	1	1	0	2	2	4	3	8.6
26	6	6	5	5	8	11	9	11	9	10	11	12	10	9	8	7	5	2	0	2	1	2	1	3	6.4
27	1	1	1	0	0	0	0	0	0	1	2	5	9	13	17	15	14	10	7	4	8	8	9	5	5.4
28	3	3	3	4	3	2	5	7	7	8	5	5	9	12	14	11	8	8	9	11	13	15	15	14	8.1
29	11	9	7	6	6	9	7	5	3	3	7	5	6	3	6	7	9	9	13	15	18	13	10	11	8.3
30	10	11	10	9	7	7	8	8	12	21	28	24	26	24	22	19	18	22	20	19	20	22	21	20	17.0
31	20	19	19	20	19	19	17	21	18	20	20	19	21	19	17	17	15	10	11	9	11	7	2	4	15.6
MEAN	10.9	10.8	10.6	10.6	10.7	11.3	10.9	10.6	10.5	11.8	13.2	13.5	13.9	14.0	13.7	13.2	12.2	10.6	10.4	10.6	11.2	11.2	11.3	11.6	11.6

PERCENTAGE OF DATA VALID 100.0 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 8662.00 TOTAL MONTHLY RECORD HOURS = 744.00

TABLE: F-33 OWMC AIR POLLUTION SURVEY

MET. DATA WIND SPEED-10m UNITS KM/HR

STATION LINCOLN COUNTY MONTH FEB 1987

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	5	2	2	1	3	6	8	7	8	13	13	12	11	15	20	22	21	18	18	21	23	19	17	17	12.6
2	17	17	16	16	17	17	15	12	12	13	13	15	13	12	12	11	14	14	14	11	13	11	7	7	13.3
3	8	8	6	6	15	12	10	12	15	14	15	15	16	18	16	14	21	17	17	****	****	****	9	8	13.0
4	13	13	17	11	13	16	16	10	10	14	14	26	34	30	27	32	28	21	16	14	13	9	9	7	17.2
5	9	8	6	2	0	1	1	2	6	8	0	4	16	19	19	19	20	15	14	15	17	16	15	7	10.0
6	10	10	10	10	7	6	7	8	11	11	10	21	19	18	25	22	21	18	15	14	11	11	11	11	13.2
7	12	10	10	8	7	9	10	11	12	11	8	8	10	11	11	13	12	10	7	8	9	6	8	7	9.5
8	15	13	13	15	19	23	27	27	25	25	21	19	22	19	19	18	25	28	28	27	27	28	26	24	22.2
9	21	21	22	21	19	17	15	13	11	14	14	13	9	8	11	9	9	10	7	15	10	19	18	21	14.5
10	19	19	26	19	14	14	15	16	16	18	19	18	18	14	13	9	9	12	7	5	3	3	4	3	13.0
11	4	5	5	5	4	4	3	3	4	3	5	1	1	1	1	1	2	2	1	2	3	3	4	4	3.0
12	4	5	6	6	7	10	9	9	9	10	13	15	12	13	10	7	4	3	6	13	19	31	29	29	11.6
13	23	14	17	19	13	9	15	16	16	13	18	16	7	4	2	1	2	3	2	2	2	0	2	0	9.0
14	4	8	12	12	12	11	10	9	12	15	16	15	12	13	14	15	22	13	11	10	12	10	8	7	11.8
15	11	14	14	13	12	11	11	10	10	12	13	12	9	7	5	4	5	1	1	1	1	13	13	9	8.8
16	8	7	9	9	6	4	5	5	7	11	17	19	18	18	20	16	15	13	13	18	15	11	7	9	11.7
17	10	6	4	6	6	9	9	9	12	16	21	19	18	18	16	14	10	11	8	6	6	3	1	0	9.9
18	0	0	1	3	4	4	3	3	3	8	12	11	10	7	6	6	4	3	1	1	2	3	3	2	4.2
19	2	3	2	2	2	2	3	3	1	6	10	8	3	3	4	6	6	11	9	9	10	8	5	4	5.1
20	2	1	6	8	4	2	0	2	1	0	1	2	3	7	6	7	5	2	1	2	0	1	2	2	2.8
21	0	1	1	1	0	1	0	0	0	2	0	1	1	1	1	0	0	4	4	4	3	3	3	3	1.4
22	2	1	3	2	3	2	1	3	3	0	0	6	2	3	3	0	1	5	9	9	8	7	8	8	3.7
23	7	8	9	9	8	7	6	6	7	9	10	9	11	15	13	13	10	10	8	7	7	6	7	13	9.0
24	14	13	11	8	11	9	6	7	5	6	11	10	6	4	2	6	11	10	10	8	7	7	8	4	8.1
25	3	4	3	5	3	2	1	3	2	4	4	5	10	8	5	9	4	2	3	1	2	2	2	3	3.8
26	3	4	2	3	3	5	1	6	6	7	9	8	10	8	10	10	11	7	5	6	3	6	6	5	6.0
27	3	5	5	5	8	9	10	11	15	16	15	13	13	11	13	12	8	8	9	8	7	5	4	8	9.2
28	9	8	8	5	5	7	6	1	5	5	7	8	8	7	11	12	16	17	14	9	11	13	****	****	8.7
MEAN	8.5	8.1	8.8	8.2	8.0	8.2	8.0	8.0	8.7	10.1	11.0	11.8	11.5	11.1	11.3	11.0	11.3	10.3	9.2	9.1	9.0	9.4	8.7	8.2	9.5

PERCENTAGE OF DATA VALID 99.3 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 6330.00 TOTAL MONTHLY RECORD HOURS = 667.00

TABLE: F-34 OWMC AIR POLLUTION SURVEY

MET. DATA WIND SPEED-10m UNITS KM/HR

STATION LINCOLN COUNTY MONTH MAR 1987

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	16	18	16	10	8	8	9	10	10	9	1	0	1	1	1	3	11	16	16	21	27	24	29	27	12.2
2	29	30	31	29	23	22	23	24	24	27	29	31	36	38	34	32	29	29	23	18	9	7	6	5	24.5
3	4	4	6	5	5	7	10	13	16	20	23	26	28	24	16	18	20	19	18	17	12	11	11	12	14.4
4	12	11	9	6	8	9	5	6	8	8	6	6	5	6	5	8	8	8	8	12	10	8	3	3	7.4
5	2	1	2	0	1	2	3	3	1	2	4	6	8	6	4	2	3	2	7	9	6	1	1	1	3.2
6	2	1	0	0	4	6	4	6	9	14	19	16	15	12	16	15	9	5	5	7	7	6	8	13	8.3
7	7	7	13	9	9	9	12	11	15	15	16	16	16	17	21	23	21	19	21	25	17	12	****	****	15.0
8	****	****	****	3	1	3	5	5	6	6	8	12	16	16	12	12	10	****	****	****	****	****	****	****	8.2
9	****	****	****	****	****	****	****	****	****	****	****	****	25	26	27	27	27	27	21	21	22	23	25	26	24.8
10	26	24	****	****	****	****	****	****	****	****	****	****	****	19	19	17	17	17	15	10	8	8	6	8	14.9
11	6	3	3	3	4	3	6	10	16	16	15	13	10	10	13	15	15	13	12	13	12	9	6	3	9.5
12	2	2	2	2	2	3	2	4	5	3	6	7	8	11	17	15	16	12	10	9	8	7	7	5	6.9
13	7	8	5	7	8	6	6	6	7	10	10	9	8	8	11	10	11	9	9	7	5	0	4	6	7.4
14	3	1	0	3	1	2	3	2	5	8	7	6	6	7	6	6	12	15	13	13	13	12	12	9	6.9
15	8	8	10	10	10	8	7	9	17	20	20	21	22	22	22	22	20	17	10	7	6	3	5	7	13.0
16	6	3	2	5	6	4	5	6	12	16	19	20	20	20	20	15	11	8	6	7	9	11	11	12	10.6
17	11	15	13	10	10	10	8	11	15	18	17	15	14	12	13	16	12	12	10	11	10	12	7	5	12.0
18	5	6	11	10	8	8	8	10	18	19	19	15	11	14	16	18	17	14	10	2	1	2	6	2	10.4
19	2	3	3	8	8	7	10	9	12	11	11	12	15	16	16	16	17	15	6	4	6	7	7	7	9.5
20	5	5	6	6	6	7	7	8	11	11	12	15	15	15	13	17	23	17	16	13	12	12	9	5	11.1
21	5	6	6	6	5	6	6	6	10	15	15	17	16	16	13	15	13	10	6	6	5	3	5	6	9.0
22	4	6	8	8	8	7	3	3	11	12	13	15	17	16	16	17	17	13	7	4	5	3	5	5	9.3
23	6	5	4	2	3	1	1	2	2	3	7	6	13	16	16	16	15	11	7	8	9	8	8	7	7.3
24	7	7	6	6	7	5	4	5	6	8	9	12	12	16	17	16	13	10	10	8	8	7	7	4	8.8
25	5	6	7	6	7	9	7	5	7	6	16	8	13	18	19	15	17	19	22	21	4	9	8	16	11.3
26	21	25	21	24	28	28	26	24	23	23	28	31	29	29	24	25	25	12	9	9	9	8	7	9	20.7
27	8	8	7	6	2	3	5	5	6	5	8	9	11	10	9	5	2	1	4	7	7	6	8	5	6.1
28	4	7	6	7	8	10	11	10	12	13	13	16	11	11	15	12	12	10	6	5	5	3	4	4	9.0
29	2	2	1	1	7	9	9	8	7	8	4	6	10	12	14	10	7	7	6	11	8	9	17	23	8.3
30	17	15	12	7	6	6	6	11	13	11	8	6	11	12	10	11	11	12	13	15	19	18	16	13	11.6
31	11	12	13	10	9	15	16	18	15	15	15	12	15	16	18	20	20	19	17	15	11	8	12	15	14.5
MEAN	8.4	8.6	8.0	7.2	7.3	7.7	7.8	8.6	11.0	12.1	13.0	13.2	14.6	15.2	15.3	15.1	14.9	13.3	11.4	11.2	9.7	8.6	9.0	9.1	10.9

PERCENTAGE OF DATA VALID 95.3 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 7727.00 TOTAL MONTHLY RECORD HOURS = 709.00

TABLE: F-35

OWMC AIR POLLUTION SURVEY

MET. DATA WIND SPEED-10m

UNITS KM/HR

STATION LINCOLN COUNTY

MONTH APR 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	8	8	9	5	1	1	2	3	4	5	11	18	16	15	13	15	13	8	7	11	13	14	13	16	9.5
2	18	17	17	22	21	16	9	12	16	25	25	25	29	31	31	34	32	34	36	34	21	21	20	16	23.4
3	12	11	8	9	9	10	8	7	9	8	10	10	6	3	6	3	4	6	7	6	8	8	9	11	7.8
4	14	16	20	25	21	24	31	25	27	24	25	24	26	26	28	26	32	37	38	36	36	39	34	39	28.0
5	39	38	31	25	23	20	25	21	20	18	15	13	20	22	23	18	21	21	18	10	10	10	13	23	20.7
6	20	15	15	16	19	17	14	12	18	17	14	14	13	12	10	12	14	14	9	11	10	6	7	10	13.3
7	8	3	5	7	7	11	7	5	13	13	16	18	18	16	16	16	16	15	11	9	10	11	11	10	11.3
8	9	9	10	11	11	11	11	12	13	11	10	10	7	7	6	4	9	13	9	11	7	5	2	2	8.8
9	2	4	4	5	4	4	5	5	5	6	8	9	10	11	15	20	21	19	16	10	9	9	9	9	9.1
10	8	8	9	9	10	7	7	7	9	11	12	10	12	14	14	14	17	15	13	9	6	7	4	3	9.8
11	2	1	4	3	2	1	1	4	5	8	8	9	10	11	8	21	24	12	11	13	13	11	9	8	8.3
12	4	6	4	4	3	5	5	6	6	6	10	12	10	14	15	16	15	11	9	3	6	6	7	9	8.0
13	9	9	7	5	3	5	6	5	10	16	18	11	11	10	7	4	4	7	7	7	7	7	8	6	7.9
14	6	5	4	7	6	6	6	5	6	8	10	14	12	12	15	12	13	11	6	4	8	10	8	8	8.4
15	6	6	6	5	3	3	3	5	5	11	9	10	10	10	7	15	14	8	4	6	10	14	12	6	7.8
16	9	9	11	11	9	11	12	13	11	7	11	11	14	10	10	10	15	14	10	7	7	9	13	10	10.6
17	10	9	11	9	10	10	8	7	9	10	11	11	12	13	13	11	11	11	10	10	6	5	2	1	9.2
18	3	5	6	3	5	3	4	4	2	2	2	3	7	11	10	8	8	9	9	8	7	8	4	6	5.7
19	5	5	4	6	9	9	8	8	7	7	7	9	11	12	13	13	13	14	13	9	6	6	6	7	8.6
20	4	3	3	6	4	1	0	0	3	4	6	6	7	8	9	10	10	12	10	8	7	5	5	4	5.6
21	4	2	1	2	5	2	3	4	7	7	9	8	9	10	11	13	13	9	6	12	24	22	19	18	9.2
22	17	21	19	18	21	20	18	19	21	23	20	20	19	20	21	20	19	18	15	13	11	9	12	11	17.7
23	8	5	4	4	3	3	1	4	7	15	16	16	17	7	12	13	12	10	11	7	5	4	2	3	7.9
24	9	8	9	9	13	20	21	24	24	24	26	30	28	25	25	24	22	21	21	12	6	4	5	6	17.3
25	7	7	7	7	9	8	8	9	13	17	21	16	17	19	21	23	22	18	16	12	6	6	4	7	12.5
26	9	8	4	6	7	8	9	8	9	13	11	10	10	8	15	16	16	16	12	9	9	7	6	5	9.6
27	3	3	3	5	6	8	4	2	6	15	16	16	19	22	19	13	22	17	20	9	5	3	8	7	10.5
28	9	8	13	12	12	11	14	14	22	22	22	23	23	24	24	26	23	21	21	14	10	6	5	5	16.0
29	7	8	7	5	3	6	9	9	17	19	19	31	31	33	35	34	34	31	34	24	27	20	23	16	20.1
30	16	12	21	17	14	12	9	13	6	17	20	22	22	24	24	23	22	16	16	12	8	7	6	6	15.2
MEAN	9.5	9.0	9.2	9.3	9.1	9.1	8.9	9.1	11.0	13.0	13.9	14.6	15.2	15.3	15.9	16.2	17.0	15.6	14.2	11.5	10.6	10.0	9.5	9.6	11.9

PERCENTAGE OF DATA VALID 100.0

**** -.INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 8590.00 TOTAL MONTHLY RECORD HOURS = 720.00

TABLE: F-36 OWMC AIR POLLUTION SURVEY

MET. DATA WIND SPEED-10m UNITS KM/HR

STATION LINCOLN COUNTY MONTH MAY 1987

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	8	5	8	12	10	9	8	6	8	13	13	13	12	15	21	23	23	24	21	16	11	9	6	5	12.5
2	6	7	4	5	6	3	1	3	3	5	4	9	11	12	10	10	10	10	10	8	4	5	6	7	6.6
3	8	8	8	9	9	9	11	11	14	16	15	14	18	21	18	18	19	22	18	12	8	6	8	8	12.8
4	8	7	7	6	8	10	12	16	19	20	17	15	15	19	20	22	21	18	14	11	5	6	4	7	12.8
5	6	4	4	1	4	3	3	6	7	8	11	12	12	12	10	10	7	7	6	9	10	7	4	5	7.0
6	4	1	0	1	1	5	7	6	7	10	10	13	16	18	21	22	23	24	20	16	12	10	7	7	10.9
7	10	9	11	8	5	3	6	10	12	12	12	11	12	12	12	11	10	10	10	6	3	5	5	5	8.8
8	5	2	1	2	2	6	4	3	3	7	6	6	17	16	18	21	23	21	14	15	7	10	8	7	9.3
9	9	10	5	10	13	15	16	19	21	24	26	28	29	32	30	30	28	28	25	25	25	18	18	21	21.0
10	18	18	17	16	12	12	10	10	8	12	9	11	11	9	7	6	6	8	7	5	3	5	4	4	9.5
11	4	4	2	4	7	8	10	16	18	16	19	21	25	28	31	34	30	29	25	18	14	11	16	16	16.9
12	16	14	15	13	10	10	8	13	15	16	16	14	13	12	11	11	10	10	11	9	3	2	3	4	10.8
13	2	2	5	2	1	5	4	7	13	16	15	12	12	14	13	13	13	14	13	9	4	3	1	0	8.0
14	5	9	7	6	7	6	6	8	12	16	17	21	23	24	25	23	22	22	17	24	11	11	12	11	14.4
15	6	11	11	11	12	11	11	18	18	17	16	15	13	12	11	11	11	12	12	11	7	4	7	7	11.5
16	2	2	3	4	2	0	2	2	3	7	9	12	11	13	15	15	18	19	17	13	12	9	7	5	8.4
17	10	7	7	5	3	4	4	4	10	13	14	14	17	18	19	20	22	21	20	15	10	6	5	5	11.4
18	6	4	4	6	7	11	10	12	13	9	8	11	15	13	15	19	20	15	15	15	15	16	19	16	12.3
19	14	14	14	14	14	14	11	14	15	13	16	19	17	15	16	17	18	17	15	14	10	7	6	8	13.8
20	9	10	7	5	6	7	9	11	11	12	12	11	10	9	8	10	9	5	9	8	7	9	10	7	8.8
21	8	6	5	6	4	5	5	6	6	8	8	8	9	8	7	6	5	8	7	3	1	2	11	13	6.5
22	11	10	9	7	9	9	6	11	15	15	20	21	24	17	14	15	14	19	14	9	8	6	5	3	12.1
23	6	6	8	4	6	6	5	9	10	15	16	18	15	16	15	17	20	13	12	9	8	3	8	10	10.6
24	9	8	6	6	5	5	3	5	9	8	7	5	3	4	5	7	5	5	5	5	5	3	2	0	5.2
25	1	0	0	0	2	5	5	7	11	11	12	12	11	9	11	11	13	12	11	11	7	7	7	8	7.7
26	6	5	6	6	4	3	3	2	3	5	5	6	5	5	10	10	9	9	7	3	2	5	3	3	5.2
27	2	6	5	6	5	4	5	7	10	15	15	16	16	18	17	18	17	17	14	9	6	6	4	4	10.1
28	5	5	7	10	10	7	10	12	14	13	11	11	12	15	18	17	10	11	15	12	11	9	8	9	10.9
29	7	8	7	5	5	5	7	7	10	9	13	16	16	14	18	19	20	18	16	15	10	7	4	3	10.8
30	2	3	4	4	3	3	5	7	10	12	10	11	14	16	18	22	21	19	15	8	9	13	22	21	11.3
31	12	5	12	11	11	10	9	11	10	10	12	10	11	12	15	17	18	15	17	12	9	6	4	4	11.0
MEAN	7.3	6.8	6.7	6.6	6.5	6.9	7.0	9.0	10.9	12.4	12.7	13.4	14.4	14.8	15.5	16.3	16.0	15.5	13.9	11.5	8.3	7.3	7.5	7.5	10.6

PERCENTAGE OF DATA VALID 100.0 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 7892.00 TOTAL MONTHLY RECORD HOURS = 744.00

TABLE: F-37

OWMC AIR POLLUTION SURVEY

MET. DATA WIND SPEED -30m

UNITS KM/HR

STATION LINCOLN COUNTY

MONTH JUN 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	DATA MISSING																								
2	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	19	5	11	9	5	7	15	5	****
3	3	2	4	3	3	2	0	0	3	3	11	14	16	14	15	11	9	5	4	7	5	5	3	8	6.3
4	8	9	14	13	11	9	8	7	15	18	18	21	23	26	28	28	33	31	20	15	14	7	4	8	16.2
5	7	8	8	9	8	3	3	9	5	5	11	7	****	22	22	23	26	26	21	17	14	18	21	21	13.7
6	10	9	11	16	13	10	13	18	16	16	16	16	22	17	20	15	17	14	13	16	16	11	11	8	14.3
7	7	5	7	7	4	7	4	4	2	1	2	1	0	0	1	8	14	17	14	10	4	4	4	4	5.5
8	13	13	17	26	16	14	10	9	15	16	16	22	****	****	****	****	****	****	****	****	****	****	****	****	15.6
9	****	****	****	****	****	****	****	****	****	****	****	****	20	14	5	4	7	5	10	4	9	4	7	2	7.6
10	4	3	2	2	8	5	7	8	7	5	4	10	11	7	7	4	7	9	5	3	2	3	9	9	5.9
11	10	24	28	33	22	18	15	16	15	7	10	8	11	16	16	8	13	21	15	14	14	15	15	14	15.8
12	17	14	10	8	5	5	4	4	5	3	2	2	11	23	14	20	22	20	26	24	24	24	23	21	13.8
13	24	26	24	26	27	21	20	22	22	20	22	18	21	24	30	27	31	23	24	24	14	9	5	5	21.2
14	4	8	3	4	5	4	4	2	1	2	2	3	3	3	4	5	7	7	3	2	7	9	8	3	4.3
15	7	5	4	3	4	4	5	3	3	2	7	13	9	9	7	3	2	3	2	2	7	10	9	7	5.4
16	22	26	15	9	11	20	24	26	33	41	45	48	49	53	53	53	53	****	****	****	****	****	****	****	34.2
17	DATA MISSING																								
18	****	****	****	****	****	****	****	****	****	****	9	10	13	16	24	21	18	17	17	8	11	10	10	8	13.7
19	8	8	8	10	10	10	17	23	22	26	23	18	26	28	27	30	26	23	21	20	14	11	7	7	17.6
20	7	8	9	10	8	9	17	20	16	16	10	16	15	15	14	15	13	9	7	2	1	0	0	0	9.9
21	3	7	9	3	0	0	0	0	1	0	2	3	3	5	9	7	7	8	7	4	1	3	2	4	3.7
22	3	7	7	7	8	8	10	9	13	20	23	26	28	27	23	23	23	24	24	21	23	27	20	11	17.3
23	14	16	17	14	13	11	9	13	9	10	16	26	27	27	29	31	29	29	23	21	17	14	13	18	18.6
24	16	15	14	13	9	30	4	21	23	24	26	29	29	31	30	24	28	24	24	18	15	11	13	11	20.1
25	9	9	8	9	10	10	8	4	4	7	7	7	9	11	10	15	14	11	16	16	7	7	7	7	9.3
26	9	5	2	4	0	2	4	5	9	15	17	21	23	24	24	24	29	30	28	24	14	11	9	10	14.3
27	10	11	16	23	27	29	27	29	33	30	34	35	23	24	22	22	23	14	17	11	7	3	4	0	19.8
28	2	4	4	1	0	0	2	0	0	1	3	3	9	17	17	22	23	23	16	13	11	11	8	7	8.2
29	9	14	10	9	8	8	9	10	10	10	14	20	26	28	30	34	31	22	7	3	3	3	7	7	13.8
30	5	9	13	7	9	5	2	3	5	7	4	3	2	2	4	5	4	11	9	8	7	5	4	2	5.6
MEAN	9.2	10.6	10.6	10.8	9.6	9.8	9.0	10.6	11.5	12.2	13.6	15.4	17.2	18.6	18.7	18.5	19.6	16.6	14.8	12.2	10.2	9.3	9.2	8.0	12.8

PERCENTAGE OF DATA VALID 85.3

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 7840.00 TOTAL MONTHLY RECORD HOURS = 614.00

TABLE: F-38 OWMC AIR POLLUTION SURVEY

MET. DATA WIND SPEED -30m UNITS KM/HR

STATION LINCOLN COUNTY MONTH JUL 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	1	1	1	0	1	1	0	2	5	13	13	10	11	9	5	4	8	4	2	0	0	3	4	4.1
2	5	2	9	5	5	7	7	7	5	4	4	9	11	14	9	4	4	2	2	0	11	11	9	11	6.5
3	11	16	14	11	11	9	9	14	14	16	14	16	16	11	14	11	11	9	9	7	4	0	0	0	10.3
4	0	0	0	0	0	4	2	4	14	16	26	30	33	37	28	26	23	28	33	35	35	37	37	37	20.2
5	30	26	21	18	18	18	18	18	23	28	28	26	26	18	30	30	21	23	18	21	18	14	13	14	21.6
6	14	16	14	9	4	4	4	9	14	16	16	18	23	23	28	26	28	30	28	16	11	14	11	14	16.3
7	11	11	11	9	7	7	4	4	4	4	4	7	16	18	7	7	7	4	11	11	9	11	7	7	8.3
8	7	4	4	7	7	7	4	7	7	9	11	11	14	14	9	9	9	9	7	9	4	2	2	7	7.5
9	7	0	0	4	4	4	7	9	7	2	4	4	7	9	9	11	11	14	11	16	11	11	7	9	7.4
10	11	11	9	9	7	2	7	4	9	4	2	4	4	7	4	2	7	7	7	2	0	0	0	7	5.3
11	7	7	7	4	2	2	4	4	7	9	11	7	9	4	4	4	2	4	4	4	4	7	7	9	5.5
12	9	9	9	14	9	9	7	4	9	4	7	7	11	9	7	7	7	4	2	7	7	7	9	7	7.5
13	4	7	4	4	2	2	2	2	9	18	18	21	28	28	30	28	33	35	26	18	18	14	14	9	15.6
14	2	11	14	14	14	9	7	9	14	28	30	26	18	18	18	14	11	7	7	2	4	7	7	7	12.4
15	2	4	5	7	4	7	7	4	2	2	4	7	7	7	9	16	14	14	11	9	9	7	4	7	7.0
16	4	4	4	2	7	7	11	9	11	7	2	2	11	14	14	11	11	9	4	4	4	4	4	2	6.8
17	0	0	0	7	4	7	4	0	4	2	23	14	16	21	16	11	9	11	11	9	4	7	7	2	7.9
18	11	18	7	4	4	2	2	0	4	2	4	4	4	11	11	21	30	21	11	18	2	9	9	28	9.9
19	****	6	****	13	13	13	6	5	7	5	****	****	****	****	****	4	10	10	9	7	6	5	3	****	7.6
20	****	2	****	****	****	****	****	****	****	****	****	****	****	****	****	****	19	19	14	9	13	8	10	14	****
21	16	13	14	13	13	12	11	11	13	17	13	11	8	8	6	7	7	7	9	8	9	2	****	****	10.4
22	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	13	12	11	11	11	11	9	11	11	****
23	9	11	12	13	13	13	9	11	11	10	11	11	12	12	12	12	12	12	12	13	13	12	12	9	11.5
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	16	14	14	9	9	9	9	11	7	4.7
25	11	11	11	11	14	11	11	14	18	23	26	28	28	26	26	28	16	7	4	7	7	9	16	18	15.9
26	14	14	11	16	21	16	16	11	11	16	18	14	11	9	9	11	14	11	14	11	9	9	4	2	12.2
27	11	14	16	13	12	9	10	10	13	13	13	13	14	12	12	13	11	11	11	8	10	9	13	8	11.6
28	7	9	9	9	7	7	6	10	12	14	16	16	14	14	16	14	15	16	16	15	16	14	17	16	12.7
29	18	21	20	20	20	21	19	18	18	21	20	19	19	19	18	19	21	16	15	13	14	13	15	13	17.9
30	15	14	15	16	17	16	17	16	16	16	15	15	17	16	14	16	16	16	14	12	12	11	14	11	14.9
31	12	12	11	9	9	6	5	4	11	11	13	13	1	0	0	0	5	16	14	2	0	0	0	4	6.6
MEAN	8.9	9.1	9.0	9.0	8.6	8.0	7.5	7.5	10.0	11.1	13.1	13.1	13.9	13.9	13.7	13.2	13.4	13.1	11.5	10.2	9.2	8.8	9.2	10.1	10.6

PERCENTAGE OF DATA VALID 94.6 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 7469.00 TOTAL MONTHLY RECORD HOURS = 704.00

TABLE: F-39

OWMC AIR POLLUTION SURVEY

MET. DATA WIND SPEED -30m

UNITS KM/HR

STATION LINCOLN COUNTY

MONTH AUG 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1											DATA MISSING														
2											DATA MISSING														
3											DATA MISSING														
4											DATA MISSING														
5											DATA MISSING														
6											DATA MISSING														
7											DATA MISSING														
8											DATA MISSING														
9											DATA MISSING														
10											DATA MISSING														
11											DATA MISSING														
12											DATA MISSING														
13											DATA MISSING														
14											DATA MISSING														
15											DATA MISSING														
16											DATA MISSING														
17											DATA MISSING														
18											DATA MISSING														
19											DATA MISSING														
20											DATA MISSING														
21											DATA MISSING														
22											DATA MISSING														
23											DATA MISSING														
24											DATA MISSING														
25											DATA MISSING														
26	****	****	****	****	****	****	****	****	****	****	****	****	1	1	1	****	****	****	****	****	****	****	****	****	****
27	33	43	31	24	20	26	23	23	15	18	20	21	21	17	23	26	23	35	21	16	14	13	13	13	22.2
28	8	8	6	16	15	15	17	19	22	13	15	31	24	20	14	13	25	19	25	22	19	12	14	15	17.0
29	12	13	9	12	12	12	11	9	11	16	20	17	14	9	7	15	19	21	17	15	14	11	9	****	13.3
30	8	8	10	10	9	9	11	8	4	6	14	14	16	20	19	18	17	15	12	9	7	6	7	9	11.1
31	3	3	9	3	0	3	7	10	6	6	7	7	7	7	5	6	5	13	13	13	12	12	8	10	7.3
MEAN	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	13.8

PERCENTAGE OF DATA VALID 16.4

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 1688.00 TOTAL MONTHLY RECORD HOURS = 122.00

TABLE: F-40 OWMC AIR POLLUTION SURVEY

MET. DATA WIND SPEED -30m UNITS KM/HR

STATION LINCOLN COUNTY MONTH SEP 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	10	6	0	1	0	3	4	10	9	4	3	4	7	7	11	11	9	11	10	3	2	0	2	8	5.6
2	10	8	0	4	5	4	2	4	0	3	2	3	4	5	8	5	7	8	8	8	8	8	9	12	5.6
3	13	11	9	7	7	7	5	4	3	0	3	5	6	5	4	8	11	11	7	7	15	15	11	8	7.6
4	8	10	10	13	12	15	16	17	19	19	22	21	21	18	15	14	15	12	12	17	18	17	19	20	15.8
5	22	15	10	7	11	11	11	12	10	14	21	27	27	25	20	21	22	19	17	14	10	8	9	12	15.6
6	13	13	11	12	10	10	7	7	8	12	13	17	16	18	19	17	14	11	13	10	8	8	7	12	11.9
7	17	10	2	2	4	3	7	5	5	7	15	17	21	19	21	22	22	20	16	11	11	11	12	8	12.0
8	8	6	6	6	1	3	1	7	10	11	18	22	22	25	28	27	25	18	18	14	9	10	12	12	13.3
9	6	6	5	8	8	8	5	7	9	9	13	12	12	14	13	15	15	14	9	5	3	7	9	9	9.2
10	5	6	7	7	11	10	10	11	14	21	16	19	11	14	13	10	9	7	9	9	11	31	36	37	13.9
11	41	39	34	29	20	17	21	29	29	30	31	31	33	27	20	20	28	22	29	33	34	37	36	29	29.1
12	22	22	22	27	33	36	28	27	31	33	27	27	29	30	33	29	27	22	19	13	12	8	7	8	23.8
13	8	9	8	7	7	11	10	13	17	18	16	19	21	20	24	24	26	24	20	18	13	11	13	11	15.3
14	7	6	8	6	5	8	7	8	2	2	2	7	9	9	10	13	16	14	11	9	4	7	6	4	7.5
15	7	7	6	0	2	0	0	0	0	0	2	7	9	11	16	14	13	9	6	24	31	23	27	24	9.9
16	11	10	9	6	4	7	9	11	8	11	13	11	11	12	12	11	10	11	9	4	7	6	11	11	9.4
17	9	11	9	7	2	2	0	0	2	4	7	9	9	7	7	7	9	13	12	12	13	12	9	9	7.5
18	11	8	9	11	9	9	11	9	7	9	11	9	9	13	11	9	8	7	7	2	0	0	0	0	7.5
19	1	3	5	5	8	10	11	10	7	5	8	11	10	7	6	7	6	5	2	6	5	6	7	7	6.6
20	7	5	9	7	8	8	5	0	5	5	7	10	9	6	7	7	6	7	6	7	10	9	13	11	7.3
21	9	12	11	8	12	10	10	10	11	15	18	17	13	10	7	9	9	11	12	13	12	12	9	9	11.2
22	8	8	7	8	8	7	6	4	5	3	2	2	2	2	2	9	16	14	13	8	1	4	8	6	6.4
23	9	9	9	9	9	9	9	9	9	9	9	9	9	9	13	13	18	15	12	10	9	8	9	4	9.9
24	2	0	0	0	0	0	0	0	0	3	11	13	13	17	12	13	13	11	7	7	7	6	2	0	5.7
25	1	1	6	2	0	2	2	3	4	2	3	0	1	7	7	4	4	4	3	6	8	8	7	4	3.7
26	2	2	2	11	7	4	4	4	2	4	11	13	16	11	16	9	8	9	11	9	7	4	8	9	7.6
27	11	18	22	20	17	13	11	24	18	11	13	14	16	9	6	9	9	9	9	7	7	9	9	7	12.4
28	4	4	2	4	4	2	2	0	0	2	2	4	2	9	11	11	9	4	2	4	8	4	3	4	4.2
29	6	6	6	6	6	6	6	6	6	6	6	6	6	6	9	13	18	15	13	11	13	18	34	36	11.0
30	39	40	40	36	32	24	19	15	13	15	18	15	13	11	11	4	6	12	9	11	13	13	15	13	18.2
MEAN	10.9	10.4	9.5	9.2	8.7	8.6	8.0	8.9	8.8	9.6	11.4	12.7	12.9	12.8	13.1	12.8	13.6	12.3	11.0	10.4	10.3	10.7	12.0	11.5	10.8

PERCENTAGE OF DATA VALID 100.0 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 7797.00 TOTAL MONTHLY RECORD HOURS = 720.00

TABLE: F-41 OWMC AIR POLLUTION SURVEY

MET. DATA WIND SPEED -30m UNITS KM/HR

STATION LINCOLN COUNTY MONTH OCT 1986

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	15	14	7	1	3	4	2	0	0	3	6	2	0	0	0	3	9	11	8	10	11	11	10	15	6.0
2	19	14	7	11	10	11	12	9	9	6	8	7	6	5	2	1	1	4	8	7	5	6	5	5	7.4
3	8	10	10	8	9	10	9	7	10	12	16	17	19	19	25	26	23	15	8	11	12	10	11	11	13.2
4	12	12	11	10	8	6	7	5	12	11	12	13	12	16	27	23	17	15	10	9	8	7	10	12	11.9
5	8	8	11	8	10	7	9	1	6	12	12	13	13	17	20	22	27	29	23	19	23	32	32	23	16.0
6	21	22	26	25	29	29	29	24	25	35	28	22	19	21	21	19	21	18	15	15	14	8	4	5	20.6
7	10	3	0	0	0	4	8	7	4	9	16	21	25	27	27	28	33	31	24	22	21	23	25	24	16.3
8	27	30	30	27	30	29	32	29	30	31	33	32	28	30	33	30	22	16	13	15	18	16	21	18	25.8
9	16	14	9	17	21	22	23	22	20	17	18	27	23	23	17	18	16	14	11	9	9	11	8	9	16.4
10	9	8	7	15	12	12	13	9	10	16	15	15	15	16	17	19	18	16	13	13	15	15	17	15	13.8
11	13	11	9	10	9	9	6	10	14	17	17	16	13	12	13	15	16	7	3	6	7	14	15	15	11.5
12	13	12	13	13	12	13	14	11	12	18	14	16	14	10	7	7	3	4	8	8	9	9	9	9	10.8
13	13	14	9	13	11	10	12	11	12	10	10	13	14	8	16	15	12	11	6	8	4	2	1	7	10.1
14	9	11	15	16	20	23	25	22	28	28	28	26	23	22	21	25	29	33	26	19	25	30	33	23	23.3
15	28	23	20	23	21	18	20	18	18	23	23	23	22	22	19	20	19	20	17	19	15	12	6	5	18.9
16	4	4	2	6	4	6	7	5	5	8	10	7	5	6	0	3	4	9	1	0	0	0	0	0	4.0
17	0	0	0	0	3	2	5	9	6	1	3	9	14	15	19	18	15	10	5	4	3	6	7	8	6.8
18	10	7	5	8	2	8	10	11	8	5	4	5	6	5	3	1	2	2	2	4	5	4	2	1	5.0
19	4	6	6	5	5	7	9	9	8	6	6	12	9	8	9	10	15	15	13	10	9	11	9	8	8.7
20	11	12	11	6	7	7	11	10	10	10	11	13	17	18	11	14	13	11	9	16	16	12	11	13	11.7
21	9	11	11	13	16	15	17	15	16	16	16	15	13	12	12	9	8	14	6	5	3	5	9	8	11.4
22	7	5	7	7	9	8	7	10	11	13	13	16	16	18	18	19	18	16	16	14	13	12	11	12	12.3
23	14	13	13	14	14	14	11	11	14	16	16	18	18	17	13	7	7	4	9	16	16	16	13	11	13.1
24	9	9	13	10	11	3	6	6	9	13	13	14	16	16	13	15	4	10	11	12	14	14	14	11	11.1
25	13	12	9	10	11	14	11	7	9	7	7	4	2	7	6	9	7	7	8	8	9	11	8	9	8.5
26	7	7	7	6	4	7	7	4	6	5	6	7	9	8	9	10	8	9	8	6	8	9	4	1	6.8
27	2	0	2	2	0	2	4	2	4	7	15	16	18	20	16	12	16	13	11	14	13	13	13	12	9.5
28	12	12	11	10	8	12	4	7	2	10	10	16	17	18	21	26	14	11	18	16	17	16	20	21	13.7
29	23	22	24	26	28	28	28	24	26	29	30	38	29	31	27	19	19	19	19	18	20	13	12	17	23.7
30	13	10	13	12	11	10	11	6	9	12	13	12	13	10	9	6	6	5	1	0	3	1	0	2	7.8
31	9	11	9	8	13	8	13	10	13	6	8	11	12	11	9	7	5	5	7	10	15	17	21	23	10.9
MEAN	11.9	11.2	10.5	11.0	11.3	11.5	12.3	10.7	11.8	13.3	14.1	15.4	14.8	15.1	14.8	14.7	13.8	13.0	10.9	11.1	11.6	11.8	11.6	11.4	12.5

PERCENTAGE OF DATA VALID 100.0 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 9290.00 TOTAL MONTHLY RECORD HOURS = 744.00

TABLE: F-42 OWMC AIR POLLUTION SURVEY

MET. DATA WIND SPEED -30m UNITS KM/HR

STATION LINCOLN COUNTY MONTH NOV 1986

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	24	26	26	20	22	23	23	23	25	27	33	32	35	36	31	30	21	13	14	14	11	10	9	4	22.2
2	6	15	9	6	0	5	7	8	7	11	16	16	14	14	15	10	9	8	9	9	10	6	0	0	8.8
3	1	3	3	6	10	7	7	7	2	0	5	20	28	29	26	24	23	22	24	20	22	15	20	23	14.5
4	16	18	18	17	15	19	13	9	13	18	14	17	15	14	13	13	10	8	7	11	12	12	13	11	13.6
5	10	11	10	11	12	13	13	11	12	14	13	14	12	11	12	9	9	12	13	9	3	0	4	3	10.0
6	0	0	1	3	1	0	0	0	4	4	2	9	10	10	11	11	9	7	1	0	0	0	0	0	3.5
7	5	9	4	2	4	0	0	2	0	0	0	0	0	1	3	2	0	0	0	0	0	0	0	0	1.3
8	0	2	1	2	3	0	3	3	11	12	19	18	16	20	27	30	25	22	21	21	13	16	23	15	13.5
9	19	11	9	15	19	23	22	24	29	36	42	44	45	46	46	48	44	37	41	40	37	33	30	25	31.9
10	20	21	19	18	15	19	22	22	22	20	20	17	14	13	9	6	4	2	1	0	0	0	3	3	12.1
11	3	1	1	3	4	0	0	0	0	0	0	0	0	4	8	10	9	3	8	6	6	7	10	8	3.8
12	0	0	0	0	0	1	0	0	0	2	1	1	8	12	11	13	11	18	24	29	33	31	23	26	10.2
13	31	26	26	26	23	22	19	16	17	17	16	14	18	21	21	21	20	23	21	24	23	19	18	16	20.8
14	15	17	15	13	13	15	17	13	12	11	13	16	****	****	34	31	23	25	26	28	31	30	32	29	20.9
15	25	18	12	14	12	9	11	12	13	14	15	17	14	8	21	21	20	19	18	20	19	17	18	10	15.7
16	7	6	7	10	10	7	5	3	5	0	1	0	0	4	0	0	0	1	1	9	11	13	13	11	5.2
17	12	13	11	4	2	16	21	17	19	18	25	31	32	32	32	26	18	12	8	9	9	7	5	4	16.0
18	8	7	6	3	1	7	9	10	10	9	13	16	15	16	20	24	28	29	26	27	23	21	22	23	15.5
19	21	20	22	23	23	18	16	14	18	18	18	11	10	9	7	10	9	11	13	13	14	12	16	16	15.1
20	17	16	16	16	14	13	11	11	14	18	14	16	12	11	12	12	12	7	7	10	8	8	3	6	11.8
21	16	15	15	16	18	19	15	13	13	18	20	16	14	18	13	16	12	10	9	5	9	10	12	10	13.8
22	10	9	9	10	4	0	0	4	7	7	7	7	8	10	12	10	8	11	13	13	11	12	10	11	8.5
23	12	7	9	9	15	16	15	13	13	14	18	19	20	15	15	17	18	17	25	30	31	29	28	23	17.8
24	24	25	28	28	23	18	24	21	24	23	25	25	26	26	26	19	16	14	12	7	8	****	12	8	20.1
25	9	15	16	13	12	12	11	13	13	20	19	15	16	14	13	9	9	6	9	6	8	7	7	9	11.7
26	8	8	7	8	6	5	5	9	8	11	12	17	14	15	19	21	26	26	24	22	12	14	12	12	13.4
27	11	10	9	9	9	8	2	5	6	2	1	10	20	22	21	15	20	17	16	18	22	22	28	27	13.8
28	28	30	20	19	18	18	18	18	16	15	22	27	29	22	24	28	25	21	16	17	12	11	14	18	20.3
29	16	18	19	14	12	14	12	9	13	10	12	16	16	15	15	8	7	9	9	9	8	5	9	10	11.9
30	10	11	9	11	9	9	10	8	9	16	19	20	20	21	20	23	18	22	21	20	17	12	11	13	15.0
MEAN	12.8	12.9	11.9	11.6	11.0	11.2	11.0	10.6	11.8	12.8	14.5	16.0	16.6	16.9	17.9	17.2	15.4	14.4	14.6	14.9	14.1	13.1	13.5	12.5	13.7

PERCENTAGE OF DATA VALID 99.6 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 9831.00 TOTAL MONTHLY RECORD HOURS = 717.00

TABLE: F-43

OWMC AIR POLLUTION SURVEY

MET. DATA WIND SPEED -30m

UNITS KM/HR

STATION LINCOLN COUNTY

MONTH DEC 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	15	16	22	20	21	22	24	21	28	28	23	24	23	21	22	23	24	23	23	24	24	24	22	21	22.4
2	20	18	13	14	18	19	21	13	11	10	13	10	8	10	13	14	12	11	15	14	13	13	12	10	13.5
3	9	7	3	0	0	2	7	8	16	20	23	29	30	33	33	26	32	34	33	40	38	42	36	29	22.1
4	45	47	43	41	35	38	35	31	39	40	38	40	39	40	39	27	28	26	26	29	32	32	32	35	35.7
5	31	32	31	28	30	27	28	23	23	23	23	19	16	18	20	19	15	13	13	12	10	10	8	9	20.0
6	28	33	35	34	35	36	35	38	37	36	32	26	26	22	20	19	17	18	14	9	7	3	3	0	23.5
7	0	0	4	7	8	8	9	12	19	24	31	34	37	36	33	31	28	22	19	16	14	13	11	10	17.8
8	11	8	9	10	20	19	20	23	23	26	27	25	27	26	27	26	27	28	24	20	21	21	18	17	21.0
9	15	14	11	9	7	3	3	5	1	0	3	1	3	5	5	8	9	16	8	13	14	19	22	19	8.9
10	15	21	23	20	20	21	34	43	43	42	41	45	43	39	36	39	32	28	23	20	20	24	19	18	29.5
11	20	20	18	12	10	5	3	0	0	6	19	20	22	24	23	17	14	16	15	21	25	28	28	26	16.3
12	30	30	31	32	27	23	20	24	21	16	20	25	24	23	23	22	21	20	17	19	23	22	18	17	22.8
13	14	19	13	11	6	8	8	5	6	9	12	9	13	12	11	10	12	7	0	3	2	1	5	7	8.5
14	20	24	26	27	29	31	26	26	33	39	39	39	40	40	37	40	35	31	41	41	39	27	26	23	32.5
15	21	19	18	15	13	11	10	9	8	11	12	11	16	10	6	3	7	7	4	3	2	1	4	12	9.7
16	10	10	10	11	9	3	5	1	0	1	0	0	0	0	0	2	2	5	7	4	7	6	3	3	4.1
17	0	0	0	2	2	4	4	7	9	4	4	7	9	11	12	9	8	3	0	4	10	14	11	11	6.0
18	10	13	13	15	13	14	9	10	12	19	25	29	24	24	23	20	18	17	16	16	17	13	16	14	16.7
19	14	13	16	20	21	20	20	23	21	19	19	12	12	12	13	10	8	8	10	13	10	9	10	5	14.1
20	5	7	9	10	8	3	6	4	4	5	8	9	8	6	1	0	0	3	4	0	7	0	2	1	4.6
21	2	5	6	7	6	4	3	5	6	9	9	5	2	4	7	14	10	8	9	7	11	11	8	14	7.2
22	17	15	15	14	15	16	15	17	17	21	27	25	30	33	34	29	31	27	29	33	31	32	33	33	24.5
23	33	37	41	36	32	29	27	23	22	18	17	18	14	10	13	10	8	5	2	3	5	1	0	1	16.9
24	6	11	15	14	15	15	16	19	20	19	20	19	18	19	22	19	24	23	22	20	20	19	12	14	17.5
25	19	17	9	6	1	0	1	9	14	20	19	20	22	25	23	15	20	19	19	19	18	17	15	10	14.9
26	10	9	9	9	9	9	11	11	12	13	15	17	17	15	12	11	11	11	3	0	3	5	3	6	9.6
27	5	4	0	0	3	1	5	3	1	0	0	0	0	1	2	1	1	0	0	0	0	0	0	2	1.2
28	2	4	1	4	9	9	10	11	7	8	10	15	23	22	19	19	20	21	18	22	13	10	8	9	12.3
29	6	8	10	14	16	13	13	16	11	12	17	19	18	15	10	7	2	0	0	2	3	4	7	8	9.6
30	8	3	2	1	10	9	4	8	7	9	11	10	11	12	11	9	9	9	7	9	9	9	9	10	8.2
31	9	9	6	5	5	2	3	1	4	4	2	4	4	4	10	9	9	10	9	6	6	9	9	9	6.2
MEAN	14.5	15.3	14.9	14.5	14.6	13.7	14.0	14.5	15.3	16.5	18.0	18.3	18.7	18.5	18.1	16.4	15.9	15.1	13.9	14.3	14.6	14.2	13.2	13.0	15.4

PERCENTAGE OF DATA VALID 100.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 11465.00 TOTAL MONTHLY RECORD HOURS = 744.00

TABLE: F-44 OWMC AIR POLLUTION SURVEY

MET. DATA WIND SPEED -30m UNITS KM/HR

STATION LINCOLN COUNTY MONTH JAN 1987

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	9	6	10	9	6	11	6	8	8	5	5	1	0	2	2	3	9	11	11	10	11	12	11	10	7.3
2	8	10	12	17	16	16	16	19	22	18	20	18	18	13	16	15	13	13	10	13	16	17	17	13	15.3
3	11	13	14	16	18	16	14	14	16	11	11	11	11	14	16	14	9	9	11	12	8	7	4	3	11.8
4	3	7	8	6	8	11	10	9	4	6	0	0	0	0	0	4	1	0	4	1	4	9	4	7	4.4
5	5	4	6	4	0	1	1	7	10	11	3	3	2	2	2	3	4	3	1	0	0	0	7	11	3.8
6	11	10	11	13	10	9	10	11	8	11	10	13	12	9	11	12	14	13	15	16	25	27	31	28	14.2
7	19	19	19	24	25	24	28	28	26	24	26	22	21	22	20	15	20	15	22	17	18	22	16	18	21.3
8	22	16	14	14	7	2	2	3	7	7	14	19	17	21	15	15	16	15	15	23	17	18	22	25	14.4
9	24	26	22	22	16	17	****	****	****	****	****	****	8	8	5	9	9	1	0	3	10	14	12	17	12.4
10	18	17	15	15	16	15	11	8	5	6	4	4	4	7	9	11	11	10	10	12	14	11	9	10	10.5
11	11	8	6	9	14	13	14	17	18	23	25	20	20	22	26	29	25	25	26	30	33	34	34	34	21.5
12	36	32	30	30	29	30	28	26	27	28	32	27	27	25	18	20	21	15	13	15	19	18	18	19	24.3
13	14	13	18	16	14	20	13	10	11	13	23	24	20	21	23	20	11	14	11	12	10	12	12	12	15.3
14	15	20	22	23	28	33	32	32	28	28	30	28	28	27	22	23	24	24	24	22	24	24	24	24	25.4
15	21	22	21	25	21	19	20	18	13	18	19	22	29	28	25	22	23	23	21	16	12	11	14	20	20.1
16	18	14	15	13	15	15	16	9	7	9	10	13	3	5	4	6	3	0	0	1	5	9	8	6	8.5
17	6	7	9	8	5	8	10	13	16	13	16	18	16	15	16	17	20	17	18	15	17	16	12	9	13.2
18	9	7	7	9	2	0	5	6	11	14	12	17	17	13	12	12	12	9	10	10	6	4	5	7	9.0
19	2	2	5	1	3	5	7	13	15	18	27	29	33	34	41	37	28	32	31	32	28	19	18	13	19.7
20	8	10	11	9	5	5	5	6	4	6	2	4	9	12	16	12	21	21	20	24	20	22	28	33	13.0
21	31	29	29	25	25	26	29	21	19	20	16	21	18	23	24	25	19	16	14	12	15	11	14	22	21.0
22	16	13	15	16	18	15	15	15	17	11	14	12	13	12	6	5	9	6	6	3	1	0	0	0	9.9
23	6	13	8	12	25	36	31	30	33	33	38	43	42	45	45	47	30	30	25	34	31	32	36	38	31.0
24	35	37	37	37	37	35	33	34	32	36	38	41	42	39	39	36	34	25	27	28	28	27	26	26	33.7
25	27	24	19	17	18	16	15	15	15	16	17	17	15	11	8	4	0	0	1	0	2	2	8	10	11.5
26	14	15	12	9	12	15	13	16	13	13	13	15	12	11	9	8	4	0	0	2	2	2	4	7	9.2
27	6	8	9	2	5	5	10	12	10	10	9	6	12	17	22	19	17	13	10	6	13	14	14	7	10.7
28	3	3	4	6	4	1	7	8	9	9	3	2	10	14	17	13	10	10	11	15	16	20	20	17	9.7
29	13	12	10	8	10	12	10	7	4	0	8	3	5	0	5	9	12	13	19	19	22	17	12	14	10.2
30	13	14	13	12	9	9	12	13	16	28	36	32	33	30	28	24	22	28	26	24	25	27	25	24	21.8
31	24	23	24	25	23	24	22	27	23	26	26	25	26	25	21	21	19	13	14	12	15	9	1	6	19.8
MEAN	14.8	14.6	14.7	14.6	14.3	15.0	14.8	15.2	14.9	15.7	16.9	17.0	16.9	17.0	16.9	16.5	15.2	13.7	13.7	14.2	15.1	15.1	15.0	15.8	15.3

PERCENTAGE OF DATA VALID 99.2 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 11294.00 TOTAL MONTHLY RECORD HOURS = 738.00

TABLE: F-45 OWMC AIR POLLUTION SURVEY

MET. DATA WIND SPEED -30m UNITS KM/HR

STATION LINCOLN COUNTY MONTH FEB 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	11	8	5	3	7	11	14	12	14	18	17	15	15	21	25	28	27	24	24	28	29	24	22	21	17.6
2	22	21	21	20	21	22	21	16	14	15	16	18	16	15	14	14	17	17	18	14	17	14	9	9	16.7
3	12	14	7	10	20	17	15	17	18	18	19	18	17	14	19	18	18	23	23	18	19	22	12	10	16.6
4	13	14	20	14	14	17	14	12	11	15	15	28	43	34	36	39	39	27	21	18	17	12	13	10	20.7
5	12	9	8	1	0	0	0	3	8	12	17	28	23	24	25	25	26	21	20	21	24	21	20	10	14.9
6	14	11	8	13	8	3	5	3	7	2	4	18	24	25	28	29	27	23	19	19	15	16	16	15	14.7
7	18	15	16	12	11	13	13	15	16	14	9	9	11	13	14	17	15	13	11	14	13	10	12	11	13.1
8	16	19	18	27	31	40	36	38	35	32	26	24	29	25	24	22	35	40	40	39	40	40	39	34	31.2
9	30	31	37	30	28	25	21	19	15	14	19	17	10	9	13	10	11	13	12	20	15	15	12	26	18.8
10	22	27	31	23	22	25	23	24	25	26	28	28	29	17	17	12	11	16	9	7	4	4	7	6	18.5
11	7	9	10	9	9	8	7	7	8	3	3	0	0	0	0	0	2	1	0	1	5	4	7	8	4.5
12	8	8	9	9	9	13	11	12	12	14	17	20	20	17	12	9	3	3	10	17	25	31	32	24	14.4
13	26	17	15	20	16	12	19	16	18	20	18	17	7	3	0	0	1	3	0	3	1	0	1	0	9.7
14	5	9	13	12	20	17	11	8	12	15	15	22	12	12	15	15	24	14	13	12	14	11	9	8	13.3
15	11	17	18	16	15	11	9	15	12	16	10	12	14	9	7	6	8	0	0	1	2	15	17	14	10.6
16	11	7	8	11	8	2	7	3	8	12	24	25	20	27	23	17	20	18	18	23	15	11	9	9	14.0
17	10	6	4	11	12	14	14	12	17	20	26	23	23	23	22	18	17	17	11	9	9	2	3	0	13.5
18	0	1	2	7	8	8	7	7	5	11	17	16	16	11	10	9	8	0	2	6	6	11	6	4	7.4
19	4	0	1	2	5	7	7	6	5	5	7	8	6	5	7	10	11	12	10	10	11	9	6	6	6.7
20	5	5	8	11	7	3	3	3	2	0	0	3	3	7	7	7	6	6	5	6	2	2	5	6	4.7
21	3	2	0	0	1	1	0	1	0	0	0	0	2	0	0	0	0	5	6	7	6	5	4	7	2.1
22	5	5	5	4	5	3	0	1	2	0	0	5	4	2	3	0	0	10	12	11	10	9	8	10	4.8
23	9	9	12	13	12	12	11	11	11	10	10	9	9	10	14	13	13	11	11	14	11	8	10	14	11.1
24	15	13	13	11	9	6	7	9	4	10	9	10	8	7	5	6	11	10	9	8	7	8	9	9	8.9
25	7	5	4	6	5	5	5	5	5	7	6	7	9	9	9	8	7	3	3	1	3	3	1	6	5.4
26	6	6	3	5	5	7	4	9	8	6	7	7	9	9	9	9	11	8	7	7	3	6	8	7	6.9
27	4	5	5	6	9	11	11	14	16	16	15	12	12	12	15	14	10	10	15	12	9	7	6	8	10.6
28	4	3	4	2	2	5	3	1	2	4	7	8	7	6	9	8	13	11	10	15	16	18	****	****	7.2
MEAN	11.1	10.6	10.9	11.0	11.4	11.4	10.6	10.7	11.1	12.0	12.9	14.5	14.2	13.1	13.6	13.0	14.0	12.8	12.1	12.9	12.4	12.1	11.2	10.8	12.1

PERCENTAGE OF DATA VALID 99.7 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 8106.00 TOTAL MONTHLY RECORD HOURS = 670.00

TABLE: F-46 OWMC AIR POLLUTION SURVEY

MET. DATA WIND SPEED -30m UNITS KM/HR

STATION LINCOLN COUNTY MONTH MAR 1987

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	21	21	21	11	11	12	13	13	13	9	2	5	2	1	0	5	15	20	21	28	32	32	35	34	15.7
2	36	37	38	32	28	28	30	30	32	32	36	28	44	41	40	37	36	35	27	20	13	11	7	5	29.3
3	4	4	8	7	6	8	12	15	19	24	31	30	34	28	21	24	25	21	21	19	13	12	11	12	17.0
4	13	12	8	6	8	8	4	7	8	7	4	3	6	6	6	6	8	6	8	12	10	6	0	1	6.8
5	0	0	0	0	0	2	2	2	0	0	2	3	6	5	3	3	0	1	7	11	8	1	0	0	2.3
6	0	0	2	0	2	8	6	10	11	14	21	18	16	16	20	19	13	7	9	11	13	11	13	17	10.7
7	12	13	20	17	16	14	17	16	18	19	18	18	19	22	25	29	28	28	32	33	25	20	21	19	20.8
8	9	11	6	7	4	2	7	7	8	3	8	12	19	18	16	17	13	9	8	****	****	7	18	24	10.6
9	26	28	29	29	29	31	31	29	34	35	33	29	31	32	32	32	32	31	25	27	27	28	29	29	29.9
10	29	28	31	28	26	27	25	24	27	26	26	23	23	23	21	20	20	19	16	12	12	10	8	10	21.4
11	8	6	5	4	4	6	8	13	18	17	16	12	11	11	16	18	18	15	15	16	13	9	6	2	11.1
12	1	1	1	1	1	3	2	2	2	0	7	6	6	11	18	17	19	16	13	12	9	9	9	6	7.2
13	8	9	6	8	8	7	7	6	8	11	11	10	9	9	12	11	12	10	9	8	6	0	4	7	8.2
14	6	2	1	4	4	6	4	3	2	8	8	6	6	7	6	7	14	17	16	16	16	16	15	11	8.4
15	11	12	15	13	13	10	10	11	18	23	21	24	27	27	27	26	23	20	16	10	9	6	9	10	16.3
16	8	3	4	8	10	8	7	7	15	16	23	21	21	20	23	17	13	11	9	11	15	17	16	17	13.3
17	17	19	17	15	15	15	11	16	18	21	19	17	12	11	11	15	13	15	15	16	18	11	4	4	14.4
18	7	9	17	15	9	11	12	12	20	20	19	18	8	13	17	20	18	15	11	3	4	8	8	3	12.4
19	0	0	4	12	12	10	15	11	13	11	11	12	16	17	18	18	19	16	6	3	9	12	12	12	11.2
20	8	8	9	11	11	12	12	12	13	13	15	19	17	17	15	20	27	19	17	15	15	13	11	8	14.0
21	7	8	9	9	10	11	9	7	11	18	17	20	18	16	17	18	16	12	7	7	8	7	7	10	11.6
22	9	9	14	13	11	7	5	3	12	13	16	15	18	16	16	18	17	15	8	4	8	5	7	9	11.2
23	10	8	8	3	7	3	2	3	0	2	6	3	15	16	17	17	17	12	8	11	13	13	12	10	9.0
24	9	9	7	8	10	6	7	4	3	4	10	13	13	19	21	18	16	14	16	16	15	15	14	12	11.6
25	13	15	15	15	15	15	12	11	11	11	25	12	23	28	26	22	27	32	33	28	19	15	13	13	18.7
26	28	31	28	32	37	33	29	31	27	28	36	37	37	34	26	29	29	13	10	9	9	7	6	9	24.8
27	8	3	4	2	0	1	2	3	4	3	7	7	11	9	9	7	0	0	4	7	9	7	9	5	5.0
28	4	9	8	8	9	10	12	12	15	13	15	16	13	13	15	14	13	10	7	8	7	4	4	3	10.1
29	3	1	0	3	11	13	15	9	7	4	3	7	11	13	13	9	4	7	9	17	14	12	29	30	10.2
30	21	23	13	9	8	8	11	16	15	12	7	7	14	12	11	12	14	16	18	22	23	25	19	15	14.6
31	13	14	18	10	13	16	19	16	13	16	17	12	14	17	19	20	19	18	14	15	9	10	13	15	15.0
MEAN	11.3	11.4	11.8	11.0	11.2	11.3	11.5	11.6	13.4	14.0	15.8	14.9	16.8	17.0	17.3	17.6	17.4	15.5	14.0	14.2	13.4	11.6	11.9	11.7	13.6

PERCENTAGE OF DATA VALID 99.7 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 10128.00 TOTAL MONTHLY RECORD HOURS = 742.00

TABLE: F-47

OWMC AIR POLLUTION SURVEY

MET. DATA WIND SPEED -30m

UNITS KM/HR

STATION LINCOLN COUNTY

MONTH APR 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	9	9	10	7	0	0	3	0	2	5	12	21	16	13	15	16	14	10	11	19	17	17	18	19	11.0
2	20	21	20	27	25	17	11	15	20	28	28	31	36	38	39	39	39	37	43	39	22	22	22	17	27.3
3	15	14	11	10	12	13	11	10	10	8	10	10	5	4	5	2	3	6	9	9	12	11	12	14	9.4
4	15	23	28	29	28	30	37	33	33	31	28	31	31	33	35	34	38	46	49	52	48	47	45	48	35.5
5	51	49	39	35	25	26	31	28	23	22	16	16	22	23	23	20	22	23	24	12	12	14	17	25	24.9
6	26	20	19	20	23	20	18	17	25	23	16	18	15	14	13	16	19	20	13	12	13	8	10	13	17.1
7	14	4	9	12	11	16	13	8	18	18	20	21	25	19	19	22	24	21	17	16	17	18	19	16	16.5
8	17	17	16	15	17	18	17	18	16	14	13	10	6	6	6	4	6	14	10	12	7	6	2	3	11.3
9	6	7	8	10	7	6	7	7	4	5	10	11	11	13	19	25	26	23	17	13	12	14	15	14	12.1
10	13	13	14	15	14	12	13	11	10	13	13	12	15	16	16	18	21	18	14	11	10	11	9	6	13.3
11	4	1	5	7	7	5	4	10	6	8	10	9	10	13	8	25	32	17	16	16	17	14	12	10	11.1
12	6	9	10	8	8	10	9	10	9	8	13	15	15	18	20	20	19	16	11	2	7	7	8	12	11.3
13	13	14	10	10	6	9	10	9	14	18	23	13	13	12	7	5	3	8	9	9	9	12	15	12	11.0
14	11	8	7	10	10	12	13	10	9	12	13	17	14	15	16	16	16	16	11	5	11	16	11	10	12.0
15	10	9	8	6	4	2	2	6	6	13	11	11	10	10	7	17	19	12	6	10	15	19	17	10	10.0
16	13	13	14	15	13	15	16	16	16	9	12	12	18	13	11	10	14	17	12	9	12	14	20	15	13.7
17	14	12	16	11	14	14	11	10	12	12	14	14	14	16	16	13	12	11	12	13	8	6	3	3	11.7
18	8	8	11	8	6	5	6	2	0	0	0	2	6	13	11	7	9	9	10	10	10	11	8	10	7.1
19	8	9	9	10	15	13	14	14	9	7	6	10	13	13	16	16	16	17	16	12	11	11	11	10	11.9
20	7	8	8	12	8	3	3	2	4	4	5	6	6	8	9	11	11	13	12	12	12	10	9	8	8.0
21	8	5	4	5	8	3	8	7	7	8	9	9	9	12	13	14	15	10	6	15	35	32	25	24	12.1
22	23	27	25	23	27	26	24	24	27	28	26	24	24	24	26	25	23	23	18	17	14	13	17	16	22.7
23	11	9	5	5	4	3	0	4	12	20	20	21	22	9	15	17	16	12	14	8	5	4	1	3	10.0
24	12	11	13	13	18	26	28	32	32	31	35	39	36	32	32	31	29	27	28	17	11	8	9	11	23.4
25	12	13	12	13	15	14	13	14	16	21	26	19	21	24	26	29	27	22	18	16	10	11	8	11	17.1
26	14	12	9	12	11	13	14	11	11	15	13	12	12	9	18	20	19	19	15	13	14	13	11	9	13.3
27	5	9	9	10	11	12	9	7	6	17	20	20	25	29	24	16	30	22	27	12	6	4	11	11	14.7
28	12	12	17	16	16	15	19	19	29	27	28	29	29	30	30	33	29	27	26	18	12	8	9	10	20.8
29	12	12	12	9	6	11	13	13	23	26	26	40	39	42	44	44	45	40	34	30	38	27	28	23	26.5
30	19	16	25	20	19	16	11	14	10	22	25	27	28	30	29	26	23	20	20	16	12	11	12	12	19.3
MEAN	13.6	13.1	13.4	13.4	12.9	12.8	12.9	12.7	14.0	15.8	16.7	17.7	18.2	18.4	18.9	19.7	20.6	19.2	17.6	15.2	14.6	14.0	13.8	13.5	15.5

PERCENTAGE OF DATA VALID 100.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 11184.00 TOTAL MONTHLY RECORD HOURS = 720.00

TABLE: F-48 OWMC AIR POLLUTION SURVEY

MET. DATA WIND SPEED -30m UNITS KM/HR

STATION LINCOLN COUNTY MONTH MAY 1987

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	13	12	13	18	17	14	13	11	10	16	16	16	14	19	26	30	30	30	26	21	16	14	11	8	17.3
2	12	12	8	10	11	8	5	5	2	5	4	8	13	13	12	11	11	10	12	10	8	9	10	12	9.2
3	12	12	13	14	14	14	15	15	18	18	17	17	21	25	23	21	23	25	22	16	12	9	12	13	16.7
4	14	13	14	12	14	17	18	21	23	24	21	19	19	23	25	27	27	23	17	15	9	11	9	14	17.9
5	12	9	8	7	12	9	8	10	8	9	13	14	14	15	12	11	10	9	7	11	16	14	9	10	10.7
6	8	4	0	1	5	11	14	9	7	11	12	15	19	23	26	28	28	30	25	21	17	14	12	12	14.7
7	16	13	15	11	7	3	12	15	16	16	15	13	14	14	14	14	12	13	12	8	2	8	10	10	11.8
8	12	7	6	8	8	8	8	4	2	7	6	6	20	19	22	27	29	25	17	19	10	15	14	12	13.0
9	15	15	10	15	19	21	22	25	27	30	33	35	37	40	38	39	35	35	33	35	34	24	26	29	28.0
10	26	24	22	22	18	10	14	14	11	13	11	14	13	11	9	6	9	12	9	6	5	9	4	6	12.4
11	5	9	9	10	14	15	18	23	22	22	25	25	31	35	39	44	39	37	32	24	19	17	22	22	23.3
12	22	19	20	18	13	13	11	17	20	22	20	17	16	14	14	13	12	12	13	11	6	6	8	9	14.4
13	8	7	11	5	7	10	10	11	15	19	18	14	13	17	15	15	16	17	16	11	6	6	4	6	11.5
14	13	14	11	10	10	9	12	11	15	21	22	27	29	30	32	31	30	30	22	22	****	****	****	****	20.0
15	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	13	13	15	15	14	10	9	13	12	****
16	6	1	5	9	9	3	0	1	2	8	9	14	13	16	18	18	23	24	21	17	16	13	12	10	11.2
17	16	11	12	10	6	9	11	7	12	16	17	19	22	23	25	26	29	27	24	20	14	11	9	10	16.1
18	11	8	7	7	10	16	13	16	16	12	10	14	19	16	19	24	25	20	20	19	20	21	25	21	16.2
19	19	19	19	19	20	19	15	18	18	16	20	23	20	18	19	20	22	21	18	18	13	10	10	11	17.7
20	13	14	11	9	10	11	13	17	17	18	18	14	14	11	9	11	11	6	10	9	11	14	15	11	12.4
21	10	7	6	8	6	6	7	8	8	10	10	9	11	9	8	7	5	8	7	3	2	5	19	19	8.3
22	17	15	13	11	14	14	9	15	19	20	27	27	32	23	18	18	17	24	17	12	10	8	7	6	16.4
23	12	11	11	8	10	10	9	11	12	19	20	22	18	20	19	20	24	16	14	12	10	4	10	12	13.9
24	11	10	9	9	9	9	4	6	10	9	8	6	3	4	5	8	5	5	5	5	5	3	1	0	6.2
25	2	1	4	2	6	11	11	9	13	12	14	14	13	11	12	13	16	15	13	14	10	9	11	11	10.3
26	10	8	9	8	5	4	3	1	2	4	4	5	4	5	13	12	10	9	7	1	3	8	5	6	6.1
27	3	10	9	11	9	8	8	9	12	19	19	19	19	22	21	22	21	22	19	10	9	9	7	8	13.5
28	11	11	13	15	15	11	14	16	17	16	13	12	13	18	23	21	12	13	19	16	15	13	12	14	14.7
29	13	12	11	9	9	9	10	9	12	10	15	20	20	17	23	24	25	23	21	19	15	11	8	8	14.7
30	7	8	9	9	7	9	10	10	12	14	12	13	17	20	23	29	27	24	19	11	14	19	29	28	15.8
31	16	6	16	15	15	13	11	14	13	13	15	12	13	15	18	21	24	19	20	16	12	11	7	8	14.3
MEAN	12.2	10.7	10.8	10.7	11.0	10.8	10.9	11.9	13.0	15.0	15.5	16.1	17.5	18.2	19.3	20.1	20.0	19.3	17.2	14.4	11.6	11.1	11.7	11.9	14.2

PERCENTAGE OF DATA VALID 97.4 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 10320.00 TOTAL MONTHLY RECORD HOURS = 725.00

TABLE F-49

Summary of of Wind Direction Distributions at OWMC Preferred Site (Percent Frequency)
June 1986 to May 1987

	Wind Direction																	
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	C	V
10 Meters - Summer	8.3	4.2	4.9	1.8	1.1	0.8	2.1	2.9	4.7	7.4	19.0	7.7	6.6	5.7	4.5	2.2	11.7	4.3
10 Meters - Fall	7.5	6.3	7.1	3.7	2.9	2.7	2.9	3.8	3.9	4.9	14.0	12.1	10.2	4.4	1.7	2.1	8.3	1.7
10 Meters - Winter	4.8	4.4	5.3	6.3	3.7	2.2	1.8	1.9	2.3	5.5	11.2	20.2	12.4	5.3	3.2	1.2	5.4	3.0
10 Meters - Spring	10.3	11.4	14.6	4.1	1.8	2.0	2.6	2.1	4.1	9.0	14.6	5.9	4.8	3.4	1.8	1.4	3.8	2.5
ANNUAL MEAN	7.7	6.6	8.0	4.1	2.4	1.9	2.4	2.7	3.7	6.6	14.5	11.7	8.6	4.7	2.7	1.7	6.8	3.1
30 Meters - Summer	9.4	5.0	4.6	2.2	1.6	1.1	2.1	3.2	5.4	8.0	20.4	8.0	7.6	7.9	3.9	1.6	4.5	4.5
30 Meters - Fall	9.2	5.1	6.2	3.7	2.8	2.6	3.5	4.4	4.2	5.8	13.8	11.3	10.8	5.6	2.7	1.0	6.9	0.8
30 Meters - Winter	5.1	3.5	5.3	6.6	3.3	1.7	1.7	1.6	2.4	4.5	9.3	19.0	14.3	7.4	4.0	1.8	7.1	1.2
30 Meters - Spring	10.6	11.5	14.7	4.6	2.4	2.1	2.5	2.2	3.6	7.0	14.8	5.7	5.1	4.1	2.4	1.8	2.6	2.1
ANNUAL MEAN	8.5	6.4	7.9	4.4	2.6	1.9	2.5	2.7	3.8	6.2	14.1	11.2	9.2	6.1	3.2	1.5	5.3	2.0

Notes: C - Calm
V - Variable

TABLE F-50

Summary of Predominant Wind Directions at OWMC Preferred Site
1986 to May 1987

Month	Predominant Direction		Other Predominant Directions		Percentage of Time Predominant Direction Prevailed		Calm		Variable	
	10 m	30 m	10 m	30 m	10 m	30 m	10 m	30 m	10 m	30 m
1986										
June	SW	SW	WSW	W/WNW/SSW	23.5	23.2	7.1	5.0	4.7	5.2
July	SW	SW	N	N	20.9	22.2	11.0	6.8	5.1	4.8
August	SW	SW	WSW	W	11.8	14.4	17.5	0.6	2.8	3.4
September	SW	SW	WSW		12.6	12.9	11.6	5.7	1.5	1.3
October	SW	SW	WSW/N	WSW/N	14.4	14.0	7.3	4.6	1.5	1.1
November	SW	W	W/WSW	SW/WSW	15.0	15.4	6.1	10.6	2.1	0.1
December	WSW	WSW	W/SW	W	26.9	27.7	3.6	8.1	2.8	1.2
1987										
January	WSW	WSW	W	W/WNW	21.6	18.9	3.8	5.2	2.4	0.5
February	SW	SW	WSW/NE/N	N/W/NE/WSW	12.1	11.5	8.9	8.0	3.9	2.1
March	NNE	NNE	NE/SSW/N	NE/SW/N	16.0	15.5	3.7	5.0	5.5	2.4
April	NE	NE	N/NNE	N/NNE	20.0	20.3	1.6	1.3	2.5	1.5
May	SW	SW	NE/SSW	NE/SSW	25.0	26.3	2.3	1.3	3.5	2.2

TABLE F-51

Summary of Wind Speed Data Measured at the OWMC Preferred Site
June 1986 to May 1987

Month	Average Wind Speed (km/hr)		Maximum Hourly Windspeed (km/hr)	
	10 m	30 m	10 m	30 m
1986				
June	9.2	12.8	36	53
July	7.5	10.6	28	37
August	7.7	13.8	44	NA
September	7.9	10.8	29	41
October	8.9	12.5	27	38
November	10.6	13.7	36	48
December	12.0	15.2	36	47
1987				
January	11.6	15.3	37	47
February	9.5	12.1	34	43
March	10.9	13.6	38	44
April	11.9	15.5	39	52
May	10.6	14.2	34	44
Summer 1986	8.0	11.8	44	53
Fall 1986	9.1	12.3	36	48
Winter 1986-1987	11.1	14.3	37	47
Spring 1987	11.1	14.4	39	52
Annual	9.9	13.4	44	59*

Notes:

NA - not available due to insufficient data

*April 1986 value

TABLE: F-52 OWMC AIR POLLUTION SURVEY

MET. DATA TEMPERATURE(10 m) UNITS DEG. C

STATION LINCOLN COUNTY MONTH JUN 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	13	13	13	12	13	13	13	16	19	20	21	22	23	23	23	21	21	18	14	13	12	12	12	11	16.3
2	9	8	8	8	8	7	8	8	8	8	9	10	10	11	11	12	****	13	14	14	13	12	11	10	10.0
3	9	7	8	6	5	4	4	7	9	11	13	14	15	16	17	18	18	19	19	20	17	15	13	12	12.3
4	12	11	12	12	12	12	12	12	14	18	19	20	22	22	24	24	25	25	25	25	22	20	17	16	18.0
5	17	17	17	17	19	20	19	18	19	16	16	14	14	15	15	15	15	13	12	13	13	13	13	14	15.6
6	14	14	14	14	14	14	14	13	14	13	13	13	13	15	16	17	18	19	19	19	18	17	15	15	15.2
7	15	15	14	14	14	13	13	13	13	14	16	19	20	21	23	24	25	26	25	23	22	21	21	20	18.5
8	20	20	21	21	21	21	20	20	21	21	23	24	24	23	23	25	25	26	26	25	24	23	20	18	22.3
9	15	14	14	12	11	11	11	13	15	17	18	19	****	****	21	22	23	24	23	23	21	18	16	13	17.0
10	12	11	10	10	11	10	10	12	14	17	20	22	23	24	26	27	27	27	26	26	25	24	23	22	19.1
11	22	22	23	22	21	21	22	23	22	20	19	19	19	21	22	22	23	21	18	17	17	17	18	18	20.4
12	18	18	18	18	18	18	18	18	19	20	20	21	21	23	24	25	26	26	22	22	22	21	20	19	20.6
13	18	18	17	17	17	17	17	17	17	17	18	19	20	21	21	21	21	21	22	22	23	22	19	17	19.1
14	15	13	13	13	13	12	11	10	12	16	18	21	23	24	23	24	26	26	26	26	24	21	19	18	18.6
15	17	16	16	16	16	16	16	17	17	17	18	19	20	20	21	21	21	22	23	25	25	23	22	21	19.4
16	20	20	20	20	19	19	19	20	20	22	23	24	25	25	26	26	27	25	20	20	17	15	15	14	20.9
17	13	12	11	10	10	9	9	10	11	11	11	11	12	13	14	16	17	17	17	17	16	15	12	11	12.7
18	10	9	8	8	7	6	6	7	10	13	16	16	17	18	19	18	19	19	19	18	18	17	14	14	13.6
19	13	13	12	12	13	14	14	15	16	17	18	18	18	18	18	17	16	16	16	17	17	17	17	17	15.8
20	17	17	16	16	17	16	15	14	14	15	16	17	18	20	20	21	21	22	21	21	20	18	16	15	17.6
21	14	14	14	12	11	11	11	13	17	20	21	21	22	22	23	23	23	24	24	24	23	22	20	18	18.6
22	16	16	16	16	16	16	17	17	18	18	20	21	24	24	25	25	26	26	27	27	27	27	25	22	21.3
23	21	21	21	20	21	20	19	18	17	18	19	21	21	24	24	24	24	24	24	23	22	21	20	20	21.1
24	19	19	19	19	19	19	16	16	16	17	17	19	18	18	16	17	16	16	16	15	15	13	12	11	16.6
25	10	9	9	8	7	7	9	13	15	16	17	18	19	19	20	20	20	19	19	17	17	16	13	13	14.6
26	14	14	14	15	14	14	15	18	20	21	22	22	23	23	23	24	24	25	25	24	22	21	20	20	19.9
27	19	20	22	22	22	22	22	22	24	25	26	24	21	23	23	23	26	27	27	27	24	23	22	22	23.3
28	22	22	22	21	21	21	22	22	24	25	25	27	27	27	27	28	28	27	26	26	25	25	24	23	24.5
29	22	23	23	21	19	18	17	18	20	22	24	26	27	27	26	26	26	26	23	22	23	23	21	19	22.6
30	18	17	16	15	15	13	12	13	16	18	19	19	20	21	22	23	23	23	23	23	21	20	19	18	18.6
MEAN	15.8	15.4	15.4	14.9	14.8	14.5	14.4	15.1	16.4	17.4	18.5	19.3	20.0	20.7	21.2	21.6	22.4	22.1	21.4	21.1	20.2	19.1	17.6	16.7	18.2

PERCENTAGE OF DATA VALID 99.6 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 13015.00 TOTAL MONTHLY RECORD HOURS = 717.00

TABLE: F-53 OWMC AIR POLLUTION SURVEY

MET. DATA TEMPERATURE(10 m) UNITS DEG. C

STATION LINCOLN COUNTY MONTH JUL 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	15	14	13	13	12	12	13	15	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
2											DATA MISSING														
3											DATA MISSING														
4											DATA MISSING														
5											DATA MISSING														
6											DATA MISSING														
7											DATA MISSING														
8											DATA MISSING														
9											DATA MISSING														
10											DATA MISSING														
11											DATA MISSING														
12											DATA MISSING														
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14											DATA MISSING														
15											DATA MISSING														
16											DATA MISSING														
17											DATA MISSING														
18											DATA MISSING														
19											DATA MISSING														
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21											DATA MISSING														
22											DATA MISSING														
23											DATA MISSING														
24											DATA MISSING														
25											DATA MISSING														
26											DATA MISSING														
27											DATA MISSING														
28											DATA MISSING														
29											DATA MISSING														
30											DATA MISSING														
31											DATA MISSING														
MEAN	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	13.4

PERCENTAGE OF DATA VALID 1.1 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 107.00 TOTAL MONTHLY RECORD HOURS = 8.00

TABLE: F-54 OWMC AIR POLLUTION SURVEY

MET. DATA TEMPERATURE(10 m) UNITS DEG. C

STATION LINCOLN COUNTY MONTH AUG 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1											DATA MISSING														
2											DATA MISSING														
3											DATA MISSING														
4											DATA MISSING														
5											DATA MISSING														
6											DATA MISSING														
7											DATA MISSING														
8											DATA MISSING														
9											DATA MISSING														
10											DATA MISSING														
11											DATA MISSING														
12	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	20	20	20	18	16	15	****
13	15	14	13	13	12	13	12	12	13	18	20	21	22	22	23	23	24	23	23	22	22	20	18	18	18.2
14	17	17	16	16	16	17	17	17	17	18	21	22	23	22	22	23	25	25	25	24	24	23	22	21	20.4
15	23	23	23	23	23	23	23	23	23	24	24	25	26	26	27	27	28	28	28	27	23	22	21	21	24.3
16	21	21	22	22	22	22	21	20	20	21	22	24	25	26	26	26	26	26	26	26	25	24	23	22	23.3
17	22	22	21	21	20	20	20	20	20	21	24	25	26	28	28	27	28	28	28	27	26	24	23	21	23.8
18	22	21	20	20	20	20	19	20	21	22	23	23	23	24	25	25	26	26	26	25	23	22	21	20	22.4
19	19	20	19	19	18	18	17	17	18	20	20	22	22	22	22	22	23	23	23	23	22	20	18	18	20.2
20	17	17	16	16	16	16	16	17	18	20	22	23	24	25	26	26	26	25	24	24	23	21	20	20	20.8
21	20	20	20	20	20	20	20	20	20	22	23	24	25	25	23	23	24	24	24	24	23	22	21	20	22.0
22	19	19	19	19	18	18	16	16	15	16	18	18	19	20	21	21	21	21	21	21	20	18	16	16	18.6
23	15	15	15	16	17	17	18	20	21	22	22	23	24	24	24	23	22	24	23	22	20	18	17	16	19.9
24	16	14	12	12	13	13	13	13	14	16	16	18	18	19	20	21	22	22	21	20	19	18	16	14	16.7
25	13	13	10	10	9	8	8	9	10	14	16	18	20	20	21	21	21	20	20	20	19	18	18	17	15.5
26	16	16	16	16	16	16	16	16	18	21	22	23	24	24	24	24	24	23	21	20	20	20	22	23	20.0
27	23	22	21	19	19	18	16	15	14	15	16	18	18	18	18	18	17	16	15	14	12	12	11	10	16.5
28	10	9	8	8	8	8	8	6	7	10	11	12	14	14	14	14	14	13	13	13	12	11	9	9	10.6
29	7	6	6	4	4	4	4	4	5	8	11	14	16	16	16	17	16	17	16	16	15	14	12	11	10.8
30	10	10	10	9	9	8	9	9	11	16	18	18	19	20	20	20	20	20	19	18	16	14	14	13	14.6
31	11	10	10	10	10	10	11	12	12	16	19	20	21	22	22	22	22	21	20	18	18	15	15	15	15.9
MEAN	16.6	16.3	15.6	15.4	15.3	15.2	14.9	15.1	15.6	17.9	19.4	20.6	21.5	21.9	22.2	22.3	22.6	22.4	21.8	21.2	20.1	18.7	17.6	17.0	18.6

PERCENTAGE OF DATA VALID 62.1 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 8614.00 TOTAL MONTHLY RECORD HOURS = 462.00

TABLE: F-55

OWMC AIR POLLUTION SURVEY

MET. DATA TEMPERATURE(10 m) UNITS DEG. C

STATION LINCOLN COUNTY MONTH SEP 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	15	14	13	12	11	11	11	12	16	19	21	22	23	24	24	24	24	24	24	23	20	19	18	17	18.4
2	17	16	15	14	13	12	12	11	15	19	21	23	24	24	25	25	25	25	24	22	21	20	19	18	19.2
3	18	17	16	16	15	14	14	14	16	19	21	23	24	25	25	24	23	24	24	23	21	21	20	19	19.8
4	18	19	20	20	20	20	21	21	22	22	22	22	23	23	23	23	23	24	23	23	23	22	21	22	21.7
5	22	21	15	13	11	11	11	11	18	20	21	22	23	23	23	23	22	22	22	20	18	18	17	17	18.5
6	16	15	15	14	13	12	11	11	13	14	15	16	17	17	18	18	19	18	17	16	15	14	14	14	15.1
7	13	12	11	11	10	9	8	8	10	12	13	14	15	15	16	16	16	15	14	13	10	9	8	7	11.9
8	6	5	5	5	4	4	3	3	8	13	16	17	17	18	18	18	18	18	17	16	15	14	14	14	11.9
9	14	14	13	12	12	11	11	10	12	16	19	20	20	21	21	21	21	21	20	18	16	14	13	12	15.9
10	13	13	13	14	15	16	16	17	18	19	20	20	19	18	19	21	22	22	21	21	21	24	24	25	18.8
11	25	24	24	22	20	20	20	20	20	21	22	22	21	21	22	23	23	23	23	24	23	22	22	21	22.0
12	20	20	20	20	20	20	20	19	19	18	18	18	19	18	18	17	16	15	15	14	13	12	11	11	17.1
13	10	10	10	10	9	10	10	10	13	15	17	18	18	17	18	19	20	19	17	15	13	11	10	9	13.7
14	7	6	5	5	4	4	4	4	7	10	12	14	14	15	16	16	16	15	14	13	12	11	10	10	10.2
15	9	9	9	8	9	9	9	9	9	9	9	10	10	10	9	9	10	11	10	10	9	8	7	7	9.1
16	7	6	5	5	3	3	2	4	8	9	9	10	10	10	11	12	12	12	11	10	10	9	9	9	8.2
17	9	7	8	6	5	4	3	3	3	9	11	12	13	13	14	15	15	15	14	13	11	10	10	9	9.7
18	9	9	11	12	12	12	13	12	13	13	15	16	17	18	18	18	17	17	17	17	16	16	16	16	14.6
19	16	15	15	14	14	15	16	16	16	16	17	17	17	18	19	19	19	19	19	18	17	17	17	17	16.8
20	17	17	16	16	17	17	16	16	16	17	16	17	17	16	16	17	17	17	16	16	16	15	15	15	16.3
21	14	14	14	13	13	13	13	13	13	13	13	14	15	15	15	16	17	16	15	13	13	13	13	13	13.9
22	13	13	13	13	13	13	13	14	14	16	16	16	16	16	16	18	21	21	21	21	19	17	18	19	16.3
23	20	20	19	16	18	19	20	19	19	19	19	20	21	22	22	22	23	22	22	20	19	19	18	18	19.8
24	18	18	18	17	17	16	17	16	16	18	20	21	22	21	23	23	23	23	21	19	18	16	17	15	18.9
25	13	12	13	13	13	13	14	14	15	17	18	19	20	20	19	19	19	19	20	19	18	17	17	18	16.6
26	18	18	18	18	18	18	17	16	16	19	22	23	24	24	23	22	23	23	22	21	20	19	19	18	20.0
27	18	18	18	17	16	16	15	15	14	14	14	15	15	16	15	15	14	14	14	14	14	14	13	14	15.1
28	14	14	14	14	14	14	15	15	15	16	18	19	20	22	22	23	23	23	23	22	22	21	20	20	18.5
29	17	19	20	21	21	21	21	20	20	20	20	21	21	21	23	25	27	26	24	23	23	25	26	26	22.1
30	26	26	26	24	22	22	21	21	22	21	22	21	22	23	23	24	23	23	21	21	21	21	19	18	22.2
MEAN	15.1	14.7	14.4	13.8	13.4	13.3	13.2	13.1	14.5	16.1	17.2	18.1	18.6	18.8	19.1	19.5	19.7	19.5	18.8	17.9	16.9	16.3	15.8	15.6	16.4

PERCENTAGE OF DATA VALID 100.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 11808.00 TOTAL MONTHLY RECORD HOURS = 720.00

TABLE: F-56

OWMC AIR POLLUTION SURVEY

MET. DATA TEMPERATURE(10 m)

UNITS DEG. C

STATION LINCOLN COUNTY

MONTH OCT 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	16	15	15	15	15	15	14	14	14	16	17	17	17	17	17	18	17	17	16	16	16	15	15	15	15.8
2	13	13	12	13	13	13	13	13	14	14	15	15	16	17	18	18	19	19	17	15	15	14	14	13	14.8
3	13	13	14	14	14	15	15	15	16	17	18	18	19	20	20	20	21	21	21	20	20	19	19	19	17.5
4	19	18	16	15	15	15	14	14	14	14	15	15	14	14	14	14	14	13	13	13	13	13	12	12	14.3
5	11	11	11	10	10	10	9	9	10	10	10	11	12	13	14	14	14	14	13	13	14	14	12	10	11.6
6	9	8	7	7	7	7	7	7	7	8	8	8	9	9	10	10	10	10	9	8	7	6	6	5	7.9
7	5	5	5	5	6	6	7	6	7	9	11	12	13	14	15	15	15	14	14	13	13	14	14	14	10.5
8	14	14	14	14	14	14	14	14	15	15	15	15	15	16	17	18	18	17	17	17	17	18	18	17	15.7
9	17	15	15	14	12	11	9	8	8	8	8	8	8	8	8	8	8	8	8	6	5	5	5	4	8.9
10	4	5	4	5	5	4	4	4	4	5	6	6	7	7	8	9	9	9	9	6	5	4	4	3	5.7
11	3	2	2	2	2	3	4	4	6	11	12	13	14	14	14	16	16	16	15	14	12	12	13	13	9.7
12	12	12	12	12	12	12	12	12	13	15	15	16	17	17	18	19	19	19	18	17	17	18	17	17	15.3
13	17	17	18	18	15	16	16	16	16	17	17	18	17	16	17	18	18	18	17	16	14	14	15	15	16.5
14	15	16	16	17	18	18	16	15	14	14	14	13	12	12	11	11	10	10	10	8	8	8	7	5	12.4
15	5	5	5	5	5	5	4	4	5	7	8	10	10	10	10	11	11	10	9	8	8	8	7	6	7.3
16	6	6	5	5	5	6	7	7	7	9	9	9	10	10	11	11	11	10	9	8	8	8	8	8	8.0
17	7	7	7	7	7	7	7	7	7	8	8	8	8	8	9	9	8	8	8	8	7	6	6	6	7.4
18	6	6	5	4	3	4	4	4	5	6	8	8	9	9	10	10	10	10	9	8	6	5	4	4	6.5
19	3	3	3	2	1	1	1	1	2	5	9	11	12	13	14	14	14	14	12	11	10	9	8	8	7.5
20	7	6	6	6	6	4	4	4	5	8	11	14	15	16	16	16	15	15	13	12	12	11	11	10	10.1
21	10	10	11	11	12	13	13	13	13	14	16	16	16	16	17	18	18	17	15	14	13	12	10	8	13.6
22	8	8	8	7	7	7	7	7	6	9	11	12	14	16	16	16	16	16	16	15	15	15	15	15	11.8
23	15	15	15	15	15	15	15	15	15	14	15	16	16	17	16	16	15	15	15	13	11	10	9	8	14.2
24	7	7	6	6	6	6	6	7	7	8	9	10	10	10	10	10	10	9	8	7	6	6	5	4	7.5
25	4	4	4	4	3	3	3	3	3	4	7	9	10	11	11	12	12	11	11	11	10	10	10	10	7.5
26	10	10	10	10	10	10	10	10	10	10	11	12	13	13	13	13	13	12	12	12	12	12	12	12	11.3
27	12	12	12	12	12	12	12	12	12	12	15	15	14	14	14	14	13	13	13	12	12	12	12	12	12.7
28	11	11	10	9	9	9	9	9	10	11	12	12	14	14	15	15	14	13	13	13	13	13	14	14	12.0
29	14	14	14	14	14	14	14	13	14	15	15	15	15	15	15	14	14	14	13	12	12	11	10	9	13.5
30	8	8	7	6	5	6	7	6	7	7	7	6	6	6	7	7	6	5	5	4	3	2	1	0	5.5
31	1	2	2	2	2	2	2	2	4	6	8	9	10	11	12	13	13	13	12	13	13	13	13	13	8.0
MEAN	9.7	9.6	9.4	9.2	9.0	9.1	9.0	8.9	9.4	10.5	11.6	12.2	12.6	13.0	13.5	13.8	13.6	13.2	12.6	11.7	11.2	10.9	10.5	10.0	11.0

PERCENTAGE OF DATA VALID 100.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 8189.00 TOTAL MONTHLY RECORD HOURS = 744.00

TABLE: F-57 OWMC AIR POLLUTION SURVEY

MET. DATA TEMPERATURE(10 m) UNITS DEG. C

STATION LINCOLN COUNTY MONTH NOV 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	13	13	12	12	13	13	13	13	14	14	15	16	16	17	18	17	16	16	13	11	10	9	0	6	12.9
2	8	7	6	5	5	5	5	5	5	5	5	6	6	6	7	6	6	5	4	3	2	1	1	0	4.8
3	-1	-2	-2	-2	-1	-1	0	0	1	3	5	7	7	7	7	7	7	7	7	9	8	8	7	7	4.0
4	6	7	7	6	6	6	5	3	4	4	4	4	4	3	3	3	2	1	0	0	0	0	-1	-1	3.2
5	-1	-1	-1	-1	-1	-1	-1	-1	0	2	3	4	5	6	6	7	7	7	7	7	7	7	7	7	3.4
6	6	6	6	7	7	6	6	6	7	7	7	9	10	11	12	11	10	9	8	7	7	5	5	4	7.5
7	4	5	5	6	5	4	4	5	6	9	10	11	11	10	9	10	10	9	9	9	9	8	-1	7	7.3
8	7	7	8	8	8	10	9	6	12	13	14	13	14	16	18	18	17	17	17	17	16	16	15	14	12.9
9	14	12	12	11	11	11	11	10	10	11	11	12	12	12	11	10	9	5	2	1	0	0	0	0	8.3
10	0	0	-1	-1	-2	-2	-2	-1	-1	0	1	2	2	2	3	3	2	1	1	0	-1	-1	-1	-1	0.1
11	0	1	1	2	2	1	1	1	1	1	1	1	1	2	3	3	3	3	2	1	1	1	0	-1	1.3
12	-1	-2	-2	-1	-1	-1	-1	-1	-1	0	1	1	2	1	-1	2	2	2	2	1	1	0	-1	-1	0.0
13	-2	-3	-4	-5	-5	-6	-6	-6	-6	-5	-5	-5	-4	-4	-4	-4	-5	-6	-6	-7	-7	-8	-8	-9	-5.4
14	-9	-9	-9	-10	-10	-10	-10	-9	-7	-6	-6	-4	-2	-2	-1	-1	-1	-1	0	0	1	1	1	2	-4.3
15	2	2	2	3	2	1	1	1	2	2	3	3	4	4	5	5	5	5	5	6	6	5	3	2	3.3
16	2	2	2	2	1	1	1	1	1	2	2	2	2	1	1	1	1	2	2	2	2	2	3	2	1.7
17	2	2	3	3	3	5	7	7	7	7	8	9	9	9	9	9	8	7	6	5	3	3	2	1	5.6
18	0	0	0	-1	-1	0	1	1	1	1	2	2	3	3	3	3	2	2	1	1	1	1	0	0	1.1
19	-1	-2	-3	-4	-5	-6	-6	-6	-6	-5	-5	-5	-4	-4	-4	-4	-4	-5	-6	-6	-6	-5	-5	-5	-4.7
20	-5	-4	-4	-4	-4	-4	-3	-3	-3	-2	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	-1	-1.7
21	1	1	0	-1	-2	-2	-2	-2	-2	-2	-1	0	0	1	1	1	1	0	0	-1	-2	-3	-4	-5	-1.0
22	-5	-6	-6	-6	-5	-5	-5	-5	-4	-2	1	2	4	5	6	6	5	4	3	4	4	3	3	3	0.2
23	2	2	2	1	1	4	5	5	6	7	8	9	10	10	10	9	9	9	9	9	9	9	9	8	6.8
24	8	8	7	6	4	4	5	4	4	4	4	4	5	5	4	4	4	3	4	3	3	3	2	2	4.3
25	1	1	1	1	2	3	2	2	3	4	4	5	7	7	7	7	6	5	4	4	4	3	3	3	3.7
26	3	3	3	4	5	4	5	5	3	-1	-2	0	-1	0	-2	-5	-1	5	4	4	5	5	5	5	2.3
27	4	4	3	3	3	3	3	3	3	3	4	6	7	6	5	6	5	4	4	4	5	6	6	7	4.5
28	7	6	5	3	2	1	1	2	2	3	5	6	6	5	5	4	4	4	4	5	4	4	4	4	4.0
29	4	4	3	3	2	3	2	1	2	3	4	5	6	6	6	6	6	5	3	3	3	3	3	2	3.7
30	2	2	1	1	0	-1	-1	-2	-1	-1	-1	-1	-1	-1	-2	-2	-3	-4	-4	-4	-4	-4	-5	-5	-1.7
MEAN	2.4	2.2	1.9	1.7	1.5	1.5	1.7	1.5	2.1	2.7	3.4	4.1	4.7	4.8	4.8	4.7	4.4	4.0	3.5	3.3	3.0	2.7	1.8	1.9	2.9

PERCENTAGE OF DATA VALID 100.0 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 2110.00 TOTAL MONTHLY RECORD HOURS = 720.00

TABLE: F-58 OWMC AIR POLLUTION SURVEY

MET. DATA TEMPERATURE(10 m) UNITS DEG. C

STATION LINCOLN COUNTY MONTH DEC 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	-5	-5	-4	-4	-4	-4	-4	-4	-4	-3	-3	-2	-1	-1	0	0	-1	-1	-1	-1	-1	-1	0	0	-2.3
2	1	1	1	0	0	1	1	1	1	2	2	1	1	2	2	2	3	3	3	3	3	3	3	3	1.8
3	3	3	3	2	2	2	2	3	4	4	5	5	5	4	4	4	4	4	3	3	2	2	1	0	3.1
4	1	0	0	0	0	0	0	0	0	0	1	2	2	2	2	0	-1	-1	-1	-1	-1	-1	-2	-2	0.0
5	-2	-2	-3	-3	-3	-3	-3	-3	-2	-1	-1	0	0	1	1	1	1	1	0	-1	-1	-1	-1	-1	-1.1
6	1	1	0	0	0	0	1	1	2	2	2	2	1	1	1	1	1	1	0	0	0	0	-1	-2	0.6
7	-4	-5	-5	-3	-2	-1	0	1	2	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	0.9
8	1	1	1	1	0	-2	-2	-2	-3	-4	-5	-5	-5	-5	-5	-5	-6	-6	-6	-5	-5	-5	-5	-4	-3.4
9	-4	-4	-4	-4	-4	-3	-3	-2	-2	-1	1	-2	0	1	2	2	1	1	2	2	3	3	3	2	-0.4
10	2	2	1	2	2	2	2	1	-1	-3	-3	-4	-4	-4	-4	-4	-5	-5	-5	-5	-5	-5	-6	-6	-2.3
11	-7	-7	-7	-7	-6	-6	-6	-6	-5	-4	-2	-2	-2	-2	-1	-1	-1	0	0	0	0	0	1	0	-3.0
12	0	0	1	0	0	0	0	0	0	-1	-1	-1	0	-1	-1	-1	-3	-4	-5	-5	-6	-6	-6	-6	-1.9
13	-7	-7	-9	-9	-10	-11	-11	-11	-11	-10	-9	-8	-7	-6	-6	-5	-5	-6	-7	-7	-7	-6	-6	-5	-7.8
14	-3	-3	-3	-3	-3	-3	-3	-3	-2	-1	-1	0	1	2	2	2	2	2	2	3	3	3	3	3	0.0
15	3	3	3	3	2	2	2	2	2	2	3	3	3	3	3	3	3	2	1	1	1	2	2	2	2.3
16	2	1	1	1	1	1	1	1	1	1	2	2	2	2	1	2	1	1	1	1	1	1	1	1	1.3
17	1	1	2	2	2	2	2	2	2	3	4	4	4	5	5	5	****	5	5	4	4	3	3	3	3.2
18	3	3	3	4	4	4	4	5	5	5	5	4	3	2	2	2	2	1	1	1	1	2	2	2	2.9
19	2	2	2	2	2	2	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	0	1.3
20	0	0	0	0	0	0	0	0	0	0	1	2	2	2	3	3	2	2	2	1	1	1	1	1	1.0
21	0	0	0	-1	-1	-2	-2	-3	-3	-1	-1	0	0	1	1	1	1	0	-1	-1	-1	-2	-2	-2	-0.8
22	-2	-2	-2	-2	-2	-2	-2	-2	-1	0	1	2	2	2	2	2	2	1	2	2	2	2	1	2	0.3
23	2	2	2	2	2	2	1	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1.0
24	1	1	1	1	0	0	-1	-1	0	1	2	3	3	4	3	2	2	2	1	****	****	****	****	****	1.3
25	****	****	****	****	****	****	****	****	****	****	****	3	3	3	3	3	3	2	2	1	1	1	1	1	2.1
26	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	1	1	1	1	1	1	1	1	1.2
27	0	0	0	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0.5
28	0	0	0	0	0	0	0	0	0	1	1	2	2	2	2	2	2	2	1	1	1	1	1	1	0.9
29	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	-1	-1	-1	-2	-2	-2	0.3
30	-2	-2	-2	-2	-2	-1	-1	-1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0.0
31	0	0	0	0	0	0	0	0	0	0	0	1	1	2	2	2	1	1	1	1	2	2	2	2	0.8
MEAN	-0.4	-0.5	-0.5	-0.5	-0.6	-0.6	-0.6	-0.6	-0.4	0.0	0.4	0.7	0.8	1.0	1.1	1.1	0.6	0.5	0.2	0.1	0.1	0.1	0.0	-0.1	0.1

PERCENTAGE OF DATA VALID 97.7 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 63.00 TOTAL MONTHLY RECORD HOURS = 727.00

TABLE: F-59 OWMC AIR POLLUTION SURVEY

MET. DATA TEMPERATURE(10 m) UNITS DEG. C

STATION LINCOLN COUNTY MONTH JAN 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	2	1	1	0	0	-1	-1	-1	-1	-1	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0.1
2	0	0	0	0	0	0	0	-1	-1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-1	-1	-1	-1	-1	-1	-1.1
3	-1	-1	-1	-1	-1	-2	-2	-4	-4	-5	-4	-4	-3	-2	-2	-2	-2	-3	-5	-7	-8	-9	-10	-10	-3.9
4	-11	-12	-12	-12	-13	-12	-12	-11	-10	-8	-8	-7	-5	-3	-3	-2	-2	-4	-5	-6	-7	-8	-8	-8	-7.9
5	-8	-8	-9	-10	-11	-11	-9	-11	-10	-9	-6	-4	-2	0	1	1	1	0	-1	-2	-3	-4	-5	-4	-5.2
6	-4	-4	-4	-3	-4	-4	-4	-5	-4	-2	-1	1	1	2	2	3	3	4	5	5	6	7	7	6	0.5
7	4	4	4	3	2	2	2	3	3	3	3	3	3	3	1	1	0	0	0	-1	-1	-1	-1	-2	1.6
8	-1	-1	-2	-2	-2	-2	-2	-2	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	-0.9
9	0	0	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	0	-1	-1	-1	0	0	-1	-1	-1	-1	-1	0	-0.7
10	0	0	-1	-1	-1	0	0	0	0	0	0	1	2	2	2	2	2	1	1	1	1	1	1	0	0.6
11	0	0	0	0	-1	-1	-1	-1	-1	-1	-2	-2	-2	-1	-1	-1	-2	-2	-2	-1	0	0	0	0	-0.9
12	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	1	1	1	2	2	2	2	2	1	2	1	1	1	0.4
13	1	1	1	2	2	2	1	1	1	2	2	2	3	2	2	2	2	1	0	0	0	0	1	1	1.3
14	1	3	3	4	4	5	5	5	4	5	5	6	6	6	6	6	6	5	6	6	6	5	5	5	4.9
15	5	5	5	5	5	5	4	4	4	4	4	4	4	4	4	3	3	2	2	2	2	1	1	0	3.4
16	-1	-1	-1	-1	-2	-2	-3	-3	-3	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-5	-5	-5	-3.3
17	-5	-4	-5	-5	-5	-6	-7	-7	-7	-6	-5	-4	-4	-3	-3	-3	-4	-4	-4	-4	-4	-4	-4	-4	-4.6
18	-3	-3	-2	-2	-1	-1	0	0	1	1	1	1	1	0	0	0	0	0	-1	-1	-2	-2	-3	-3	-0.8
19	-3	-4	-4	-3	-3	-3	-4	-4	-4	-3	-2	-2	-2	-3	-3	-3	-3	-4	-4	-5	-5	-5	-6	-6	-3.7
20	-7	-7	-8	-9	-9	-10	-10	-12	-11	-10	-8	-6	-4	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-3	-5.6
21	-4	-4	-4	-5	-5	-5	-6	-6	-8	-7	-5	-4	-3	-2	-2	-3	-3	-3	-4	-4	-3	-3	-2	-1	-4.0
22	-2	-2	-2	-3	-3	-4	-5	-5	-4	-3	-2	-1	-1	-1	-1	-1	-2	-2	-3	-3	-3	-3	-3	-3	-2.6
23	-3	-4	-5	-6	-5	-5	-7	-8	-9	-9	-10	-11	-11	-12	-12	-13	-14	-15	-15	-15	-15	-15	-15	-16	-10.4
24	-16	-15	-15	-15	-16	-16	-17	-17	-17	-17	-16	-15	-14	-14	-13	-13	-14	-15	-15	-15	-15	-15	-15	-15	-15.2
25	-15	-15	-15	-15	-16	-16	-16	-15	-15	-13	-11	-10	-9	-9	-8	-8	-8	-9	-10	-11	-11	-12	-12	-12	-12.1
26	-11	-11	-10	-9	-8	-7	-7	-7	-8	-7	-7	-6	-7	-7	-7	-7	-7	-8	-8	-9	-11	-13	-15	-15	-8.8
27	-16	-16	-17	-18	-18	-18	-18	-18	-17	-14	-12	-9	-6	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-10.5
28	-5	-5	-5	-5	-5	-5	-5	-4	-4	-4	-4	-4	-4	-3	-2	-2	-3	-3	-3	-3	-3	-3	-3	-2	-3.7
29	-2	-2	-3	-3	-3	-3	-3	-4	-4	-4	-3	-3	-3	-2	-2	-2	-2	-3	-4	-4	-3	-3	-3	-4	-3.0
30	-3	-2	-2	-2	-1	-1	-1	0	1	2	2	1	1	1	1	1	1	1	0	0	0	0	-1	-2	-0.1
31	-3	-3	-3	-3	-4	-4	-4	-4	-4	-4	-4	-3	-3	-2	-2	-2	-3	-4	-5	-6	-7	-7	-8	-9	-4.2
MEAN	-3.6	-3.6	-3.8	-3.9	-4.1	-4.1	-4.3	-4.5	-4.4	-3.8	-3.2	-2.7	-2.2	-1.8	-1.7	-1.7	-2.0	-2.5	-2.8	-3.1	-3.1	-3.4	-3.6	-3.8	-3.2

PERCENTAGE OF DATA VALID 100.0 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= -2407.00 TOTAL MONTHLY RECORD HOURS = 744.00

TABLE: F-60 OWMC AIR POLLUTION SURVEY

MET. DATA TEMPERATURE(10 m) UNITS DEG. C

STATION LINCOLN COUNTY MONTH FEB 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	-10	-10	-10	-9	-8	-7	-5	-4	-3	-1	0	0	1	3	4	4	4	3	3	4	4	3	2	2	-1.3
2	2	2	2	2	1	1	0	1	1	2	2	2	2	2	2	2	1	1	1	0	0	0	0	0	1.2
3	0	0	0	2	3	3	3	3	3	3	3	3	4	4	4	4	3	3	2	2	1	1	1	1	2.3
4	1	1	1	1	0	0	0	-1	0	0	0	1	1	0	0	-2	-1	-2	-3	-4	-5	-6	-7	-7	-1.3
5	-6	-6	-6	-6	-6	-6	-6	-6	-5	-4	-4	-3	-2	-1	-1	-1	-1	-2	-2	-2	-2	-2	-2	-2	-3.5
6	-2	-2	-3	-4	-4	-5	-5	-4	-4	-3	-2	-1	1	2	2	3	2	2	2	2	2	2	2	1	-0.7
7	0	0	0	-1	-1	-1	0	0	1	1	2	4	4	4	3	3	2	1	0	0	0	-1	0	1	0.9
8	1	2	3	4	5	5	5	5	5	3	3	3	2	2	1	-1	-5	-6	-7	-7	-8	-9	-11	-11	-0.7
9	-12	-12	-12	-13	-14	-14	-14	-13	-14	-13	-13	-12	-11	-10	-9	-7	-6	-7	-8	-8	-7	-7	-6	-5	-10.3
10	-3	-2	-2	-2	-3	-2	-2	-3	-3	-2	0	0	2	2	2	2	2	1	0	-1	-2	-4	-5	-6	-1.3
11	-6	-7	-8	-8	-8	-8	-8	-8	-8	-6	-5	-3	-1	-1	0	0	0	0	-1	-1	-2	-2	-2	-2	-4.0
12	-3	-3	-3	-2	-3	-3	-3	-3	-3	-2	-1	0	-1	-2	-1	-2	-1	-1	-1	0	0	1	0	-3	-1.7
13	-5	-7	-8	-9	-10	-10	-10	-11	-11	-11	-12	-12	-12	-11	-10	-9	-9	-9	-10	-10	-10	-10	-11	-11	-9.9
14	-11	-11	-11	-11	-11	-12	-12	-11	-12	-12	-12	-12	-12	-11	-11	-11	-12	-12	-12	-12	-13	-13	-14	-15	-11.9
15	-15	-15	-16	-16	-16	-17	-17	-17	-17	-17	-17	-17	-17	-16	-16	-16	-15	-15	-15	-16	-16	-15	-14	-14	-15.9
16	-15	-15	-15	-14	-14	-14	-14	-14	-14	-13	-13	-12	-11	-10	-10	-10	-9	-9	-10	-10	-10	-10	-10	-10	-11.9
17	-10	-11	-11	-12	-11	-11	-11	-10	-9	-7	-6	-5	-4	-4	-4	-4	-4	-4	-5	-5	-6	-10	-11	-10	-7.7
18	-6	-6	-7	-6	-5	-6	-6	-6	-6	-5	-4	-4	-4	-4	-3	-3	-3	-3	-4	-4	-4	-5	-5	-6	-4.8
19	-7	-7	-8	-8	-11	-12	-12	-13	-10	-8	-4	-2	-1	-1	0	1	1	0	-1	-2	-3	-4	-4	-5	-5.0
20	-6	-7	-6	-6	-6	-8	-9	-10	-9	-6	-3	-2	-1	0	1	1	1	0	0	-2	-2	-3	-4	-5	-3.8
21	-5	-6	-7	-6	-6	-7	-7	-7	-7	-5	-3	-1	1	2	3	4	4	3	0	0	-1	-1	-2	-2	-2.3
22	-3	-4	-4	-4	-3	-3	-2	-2	-2	-1	0	2	3	3	4	5	4	1	1	1	1	1	1	1	0.0
23	1	0	0	0	0	0	-1	-2	-1	0	0	0	0	0	1	2	2	2	2	1	0	-1	-2	-3	0.0
24	-3	-4	-4	-4	-5	-5	-6	-6	-3	-2	-3	-2	-2	-1	0	0	1	0	-1	-2	-3	-3	-4	-4	-2.8
25	-5	-6	-6	-7	-7	-7	-8	-8	-6	-3	-2	-1	-1	0	0	0	0	0	-1	-2	-3	-3	-4	-5	-3.5
26	-5	-4	-5	-5	-6	-6	-6	-5	-4	-2	-1	0	0	0	1	1	0	0	0	-2	-2	-2	-2	-3	-2.4
27	-3	-3	-3	-4	-4	-4	-4	-4	-3	-1	0	1	3	4	4	5	4	0	3	2	1	1	1	1	-0.1
28	1	1	1	1	1	1	1	1	1	1	1	2	3	3	3	3	2	3	3	3	3	3	****	****	1.9
MEAN	-4.8	-5.1	-5.3	-5.3	-5.4	-5.6	-5.7	-5.6	-5.1	-4.1	-3.4	-2.5	-1.9	-1.5	-1.1	-0.9	-1.2	-1.8	-2.3	-2.7	-3.1	-3.5	-4.2	-4.5	-3.6

PERCENTAGE OF DATA VALID 99.7 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= -2414.00 TOTAL MONTHLY RECORD HOURS = 670.00

TABLE: F-61

OWMC AIR POLLUTION SURVEY

MET. DATA TEMPERATURE(10 m) UNITS DEG. C

STATION LINCOLN COUNTY MONTH MAR 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	1	1	1	1	1	1	2	2	2	3	3	3	3	3	4	4	5	5	4	4	3	3	2	2	2.6
2	2	2	1	1	1	1	1	1	0	0	0	0	0	-1	-1	0	0	0	0	-1	-1	-1	-2	-2	0.0
3	-2	-3	-3	-3	-3	-3	-3	-2	-2	-2	-2	-2	-2	-2	-3	-4	-4	-5	-6	-6	-6	-6	-6	-6	-3.6
4	-6	-7	-7	-7	-7	-7	-8	-8	-7	-6	-5	-5	-4	-3	-3	-2	-2	-2	-2	-2	-2	-2	-4	-4	-4.7
5	-2	-4	-4	-4	-4	-4	-5	-5	-5	-6	-3	-2	-2	-2	-1	0	0	1	0	-2	-2	-2	-3	-3	-2.7
6	-2	-4	-5	-5	-5	-4	-5	-4	-2	1	3	5	6	7	8	9	9	10	9	7	6	3	3	2	2.2
7	1	2	2	1	4	3	2	3	3	3	5	6	8	8	11	12	11	11	12	11	11	11	10	10	6.7
8	10	10	8	5	5	4	3	3	1	2	2	5	8	12	14	14	14	15	15	15	10	6	5	4	7.9
9	4	3	3	2	2	1	0	0	-2	-4	-6	-8	-8	-8	-7	-7	-6	-8	-8	-8	-8	-8	-9	-10	-4.2
10	-11	-12	-12	-12	-12	-13	-13	-13	-12	-12	-12	-11	-10	-9	-9	-9	-9	-9	-9	-10	-10	-10	-11	-11	-10.9
11	-11	-11	-12	-12	-12	-12	-12	-12	-10	-9	-7	-6	-8	-3	-2	-3	-3	-3	-4	-5	-6	-6	-6	-6	-7.5
12	-7	-6	-6	-6	-6	-5	-5	-5	-4	-2	0	0	1	2	2	1	0	-1	-1	-1	-2	-3	-3	-4	-2.5
13	-5	-4	-5	-6	-6	-6	-6	-5	-3	-2	-2	-1	-1	0	0	0	0	0	-1	-1	-2	-3	-3	-4	-2.8
14	-5	-5	-6	-6	-6	-6	-5	-5	-3	-2	-1	-1	0	0	0	0	0	0	-1	-1	-1	-1	-1	-1	-2.4
15	-1	-1	-2	-2	-2	-3	-5	-3	-3	-1	1	1	1	1	2	2	2	1	1	0	-1	-2	-2	-2	-0.8
16	-3	-4	-3	-4	-4	-4	-4	-4	-4	-2	-1	0	0	1	1	1	0	1	1	1	1	0	0	-1	-1.3
17	-1	-2	-2	-1	-1	-2	-2	-2	-2	0	0	2	3	5	6	7	7	5	2	2	1	1	-1	-1	1.0
18	-1	-1	-1	-2	-2	-2	-3	-2	0	1	2	3	4	5	4	5	5	4	2	1	0	0	1	0	1.0
19	0	0	-1	0	-1	-1	0	0	2	3	4	4	5	7	8	8	8	8	6	5	4	3	4	3	3.3
20	3	2	1	1	1	0	0	1	2	4	5	6	6	7	8	8	7	6	4	3	3	2	1	0	3.4
21	0	0	0	0	0	0	0	0	1	3	4	5	5	6	7	8	8	8	8	7	5	5	4	4	3.7
22	3	3	3	3	3	4	3	2	3	5	6	8	10	11	11	11	11	12	12	10	9	6	5	5	6.6
23	5	3	2	2	1	1	1	0	1	5	8	11	11	11	11	12	13	11	9	6	6	6	7	7	6.3
24	7	7	6	6	4	3	3	3	6	11	13	15	18	16	16	16	15	13	9	7	8	10	10	10	9.7
25	11	11	10	9	9	10	10	9	9	10	11	8	9	11	13	13	13	13	12	10	10	10	9	9	10.4
26	9	7	5	4	4	5	5	5	5	5	6	7	7	7	7	6	6	5	6	6	5	5	5	5	5.7
27	5	5	5	5	4	4	3	3	3	3	4	5	7	9	10	10	10	10	9	8	8	7	7	7	6.3
28	7	7	7	6	6	4	4	4	4	5	7	10	12	12	12	12	11	11	10	9	8	8	7	7	7.9
29	5	4	3	3	2	2	3	3	3	6	10	12	14	15	16	16	16	16	17	15	15	16	16	15	10.1
30	17	16	15	15	14	12	11	9	9	10	10	10	11	9	7	4	3	3	2	2	1	0	-1	-1	7.8
31	-2	-2	-2	-2	-2	-3	-3	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-5	-5	-6	-6	-6	-5	-3.9
MEAN	1.0	0.5	0.0	-0.3	-0.4	-0.6	-0.9	-0.8	-0.3	0.9	2.0	2.8	3.5	4.3	4.8	4.8	4.7	4.4	3.6	2.8	2.2	1.7	1.2	0.9	1.8

PERCENTAGE OF DATA VALID 100.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 1331.00 TOTAL MONTHLY RECORD HOURS = 744.00

TABLE: F-62

OWMC AIR POLLUTION SURVEY

MET. DATA TEMPERATURE(10 m)

UNITS DEG. C

STATION LINCOLN COUNTY

MONTH APR 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	-5	-4	-5	-6	-6	-7	-7	-6	-3	0	1	1	1	2	4	3	3	2	2	2	1	2	2	2	-0.9
2	1	1	3	3	1	1	0	1	0	3	3	2	2	1	2	2	2	1	1	0	0	0	0	0	1.3
3	-1	-2	-2	-2	-2	-2	-3	-3	-2	0	1	1	1	2	2	2	2	2	2	1	1	1	1	0	0.0
4	0	1	1	1	1	1	1	0	0	0	0	0	0	1	1	2	2	3	4	5	5	6	6	6	2.0
5	6	6	6	6	6	6	5	5	5	7	8	7	6	6	6	6	5	5	5	5	5	4	5	5	5.7
6	5	5	5	5	5	5	5	5	6	6	6	6	6	6	6	7	7	7	7	7	7	7	8	8	6.1
7	8	8	8	8	8	8	7	8	9	9	10	12	13	14	14	15	15	15	14	12	10	9	8	7	10.4
8	6	6	5	4	3	3	2	2	3	4	5	6	7	8	9	10	11	8	7	6	5	4	3	2	5.4
9	1	1	1	3	4	2	1	1	3	8	11	12	13	14	13	13	13	12	11	9	7	7	7	6	7.2
10	6	5	5	5	4	3	2	3	6	10	13	15	16	17	17	18	17	17	16	15	13	11	10	9	10.5
11	7	5	4	4	5	4	4	6	9	13	17	18	17	15	16	19	17	15	12	10	9	8	6	5	10.2
12	5	5	5	5	5	6	6	6	7	8	8	8	7	8	8	8	7	8	7	8	7	6	6	6	6.7
13	6	6	7	6	6	6	6	6	8	9	11	11	11	11	12	14	15	15	12	10	9	8	8	8	9.2
14	10	9	9	7	6	5	7	7	9	12	15	16	16	16	14	14	11	9	10	9	9	11	11	11	10.5
15	11	11	11	11	8	8	8	8	9	12	13	14	14	16	14	16	17	16	14	13	14	14	13	12	12.4
16	12	11	11	10	9	9	8	8	8	7	8	8	9	11	13	14	16	16	12	11	11	12	14	14	10.9
17	13	13	12	13	11	11	10	9	9	9	10	9	9	10	11	11	11	12	11	9	8	7	6	6	10.0
18	6	7	6	6	7	6	6	6	6	7	10	13	15	16	16	16	17	17	17	16	15	14	11	9	11.0
19	9	9	8	9	8	9	9	8	8	9	13	17	20	19	20	21	21	21	22	21	20	17	16	15	14.5
20	14	14	14	15	14	12	12	13	15	18	21	23	23	25	25	25	25	25	23	20	20	19	19	19	18.9
21	17	15	13	12	11	11	11	11	11	16	19	22	24	26	24	24	23	23	22	20	15	13	12	12	17.0
22	10	9	8	8	8	8	7	7	6	6	7	7	8	9	9	10	11	11	11	11	10	9	8	9	8.6
23	9	9	9	8	8	8	7	8	12	17	18	18	16	14	11	9	9	9	9	8	8	9	9	9	10.5
24	8	7	7	7	7	7	7	7	7	7	7	8	8	9	9	10	11	12	11	10	9	8	7	6	8.2
25	5	4	4	4	3	3	3	4	6	8	10	10	10	10	11	12	13	13	13	11	9	9	8	7	7.9
26	8	8	8	8	8	8	8	8	9	11	13	15	15	16	16	16	16	16	15	14	12	12	11	10	11.7
27	9	9	8	8	8	7	6	7	10	13	14	16	18	19	19	18	16	12	9	6	5	5	5	5	10.5
28	5	5	5	5	4	4	4	4	4	5	6	6	6	6	7	8	8	7	7	7	6	6	5	3	5.5
29	3	2	1	1	1	3	4	5	7	9	10	13	14	17	19	18	17	17	15	13	11	9	8	7	9.3
30	6	6	6	5	5	5	4	5	5	6	6	7	7	8	9	10	10	10	10	10	8	7	5	4	6.8
MEAN	6.7	6.4	6.1	6.0	5.5	5.3	5.0	5.3	6.4	8.3	9.8	10.7	11.1	11.7	11.9	12.4	12.3	11.9	11.0	10.0	9.0	8.5	7.9	7.4	8.6

PERCENTAGE OF DATA VALID 100.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 6193.00 TOTAL MONTHLY RECORD HOURS = 720.00

TABLE: F-63

OWMC AIR POLLUTION SURVEY

MET. DATA TEMPERATURE(10 m)

UNITS DEG. C

STATION LINCOLN COUNTY

MONTH MAY 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	4	2	2	1	1	1	1	2	6	9	11	12	12	13	13	12	13	13	12	12	10	9	8	7	7.8
2	7	7	7	6	5	5	4	5	8	12	14	13	15	15	15	15	15	15	15	13	12	10	8	7	10.3
3	7	5	5	4	4	4	4	5	6	7	8	8	8	10	10	11	11	11	11	11	9	8	7	4	7.4
4	4	4	4	5	4	4	4	5	7	8	9	10	11	12	12	12	12	13	13	12	10	9	6	6	8.2
5	6	6	6	4	5	4	3	5	9	11	14	15	15	16	17	17	18	18	18	16	13	11	10	10	11.1
6	9	7	6	5	4	3	4	6	10	14	16	18	20	18	18	19	18	19	19	17	15	13	12	11	12.5
7	10	11	12	10	9	7	8	10	11	12	12	13	14	15	16	16	15	15	14	13	12	11	10	9	11.9
8	8	7	5	4	2	1	2	3	8	11	13	14	14	14	15	15	15	15	16	17	15	12	11	10	10.3
9	11	10	9	10	10	11	11	12	13	15	17	18	19	20	20	22	22	23	23	22	21	20	19	18	16.5
10	19	18	18	17	16	15	15	15	18	21	24	23	24	24	25	25	25	24	23	21	18	16	16	14	19.8
11	14	13	14	14	16	16	16	17	18	20	21	23	25	26	26	27	27	26	25	23	22	20	21	18	20.3
12	17	17	15	12	12	11	10	10	10	10	11	11	12	13	14	14	15	15	15	14	12	11	10	9	12.5
13	7	6	7	6	5	5	4	7	11	13	15	17	17	17	17	18	18	17	16	15	13	11	9	9	11.7
14	12	15	15	14	14	14	13	15	16	17	19	21	23	24	26	26	26	27	26	24	****	14	14	13	18.6
15	12	12	13	12	11	11	11	11	11	11	11	12	12	13	14	15	16	15	15	14	12	11	9	9	12.2
16	8	6	5	5	5	4	3	5	9	11	14	15	16	17	17	17	18	18	18	16	14	13	12	12	11.6
17	13	12	13	13	12	12	12	15	18	20	21	22	23	24	24	25	25	24	24	23	22	20	17	16	18.8
18	15	15	15	12	9	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	11	10	****
19	10	10	10	10	10	10	10	10	11	12	12	14	15	16	17	17	17	16	15	15	15	14	14	14	13.1
20	14	14	13	13	13	13	13	12	13	13	14	15	15	16	17	18	18	18	16	15	16	15	14	14	14.7
21	13	13	13	13	13	13	13	13	14	14	15	17	20	22	23	24	26	24	23	22	21	20	22	21	18.0
22	19	18	17	17	17	17	17	18	19	18	22	24	25	20	20	22	24	25	25	24	22	15	13	13	19.6
23	14	15	14	13	14	12	12	14	17	18	19	19	19	18	18	19	18	17	16	16	15	14	14	13	15.8
24	12	11	9	8	6	5	5	7	10	11	11	11	11	12	12	12	12	12	12	12	12	12	11	11	10.3
25	9	6	5	4	5	5	5	8	11	12	13	13	14	14	15	16	16	16	16	15	13	11	9	10	10.9
26	9	9	7	7	7	7	7	7	9	11	13	13	15	19	23	24	23	21	21	22	21	21	19	17	14.7
27	15	13	13	13	13	12	12	14	15	18	20	22	24	25	26	27	27	27	27	26	24	20	17	16	19.4
28	16	17	18	19	18	17	17	20	22	24	26	28	29	29	30	27	26	28	29	27	26	25	24	23	23.5
29	23	23	22	21	19	18	17	20	23	27	29	31	31	31	****	****	****	****	****	****	****	****	****	****	23.9
30											DATA MISSING														
31											DATA MISSING														
MEAN	11.6	11.1	10.8	10.1	9.6	9.2	9.0	10.4	12.6	14.3	15.9	16.9	17.8	18.3	18.5	19.0	19.1	19.0	18.6	17.7	16.0	14.3	13.1	12.3	14.3

PERCENTAGE OF DATA VALID 89.8

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 9555.00 TOTAL MONTHLY RECORD HOURS = 668.00

TABLE: F-64 OWMC AIR POLLUTION SURVEY

MET. DATA TEMPERATURE(30 m) UNITS DEG. C

STATION LINCOLN COUNTY MONTH JUN 1986

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	12	12	12	12	12	13	14	18	20	20	21	22	22	22	19	22	17	13	12	11	11	11	10	9	15.3
2	7	7	7	7	6	7	7	7	7	8	8	9	10	11	12	****	12	13	13	12	11	11	10	9	9.2
3	8	8	8	8	7	5	6	8	9	11	12	14	14	15	16	17	18	18	18	17	15	13	13	13	12.1
4	13	13	12	12	12	12	12	12	14	18	19	20	21	22	23	24	24	24	24	22	19	18	16	16	17.6
5	16	17	17	18	19	19	18	17	16	16	14	13	13	14	14	14	14	12	12	13	12	12	12	13	14.8
6	13	14	14	13	13	13	13	13	12	12	13	13	13	15	17	18	18	18	18	17	16	15	14	14	14.5
7	14	13	13	13	13	12	12	13	14	14	16	20	21	22	23	25	25	25	23	21	21	21	20	19	18.0
8	20	20	21	20	20	19	20	20	21	21	23	23	22	23	24	25	25	26	25	24	22	20	17	16	21.5
9	14	14	12	11	11	11	11	12	15	16	17	18	19	20	21	21	23	23	22	21	20	18	15	15	16.7
10	14	12	12	12	13	12	12	13	15	18	20	22	24	25	26	26	26	26	26	25	24	22	22	22	19.5
11	21	22	21	21	20	21	21	22	21	19	18	17	21	21	21	21	22	19	16	16	16	16	15	16	19.3
12	16	16	15	15	17	17	17	18	18	20	20	20	21	23	24	24	26	23	21	21	21	19	19	17	19.5
13	17	16	16	16	16	16	16	16	16	16	17	18	19	20	20	20	20	20	21	21	22	21	20	17	18.2
14	16	15	14	14	13	13	12	11	13	16	18	20	22	23	24	25	24	26	26	25	22	19	18	17	18.6
15	16	16	16	16	16	16	16	16	16	17	17	18	19	20	20	21	21	22	23	25	24	23	21	19	18.9
16	19	20	20	19	19	19	19	19	20	21	22	23	24	24	25	26	****	22	20	19	16	15	14	14	20.0
17	13	12	11	10	10	9	9	10	11	11	11	11	12	14	15	16	17	17	17	17	16	14	13	11	12.8
18	11	9	8	8	7	7	7	7	10	14	16	16	17	18	18	18	19	19	18	18	18	17	14	14	13.7
19	14	14	13	13	14	14	15	16	17	18	18	18	18	18	18	17	16	17	17	17	17	17	17	17	16.3
20	17	17	16	17	16	15	15	14	14	15	16	18	19	20	20	21	21	22	21	21	20	19	18	18	17.9
21	16	15	14	14	14	14	12	14	18	20	21	21	22	22	23	23	24	24	24	24	23	22	21	20	19.4
22	20	18	17	17	16	17	17	18	18	19	21	23	24	24	25	26	26	26	27	28	28	27	25	23	22.1
23	21	21	21	21	21	20	19	18	18	19	20	22	23	25	26	26	26	26	26	25	24	22	22	22	22.3
24	21	21	21	20	21	20	18	17	18	19	19	20	20	19	18	18	18	17	17	17	16	15	13	12	18.1
25	12	11	10	10	10	9	9	10	13	15	17	18	19	19	19	20	21	21	21	20	19	18	17	17	15.6
26	16	16	16	16	16	16	16	17	19	21	23	23	24	24	25	24	25	26	26	26	25	23	22	21	21.1
27	22	22	23	24	24	25	24	24	25	26	27	28	24	24	21	22	25	26	26	27	23	22	21	22	24.0
28	22	21	22	22	22	22	22	22	23	24	25	26	26	27	27	27	27	27	26	25	24	24	24	23	24.2
29	22	23	23	20	19	18	18	18	19	22	24	25	26	27	25	26	25	25	22	22	22	22	21	20	22.3
30	18	18	16	15	14	13	13	13	14	16	18	19	19	20	21	22	22	21	21	21	19	19	17	16	17.7
MEAN	16.0	15.8	15.4	15.1	15.0	14.8	14.7	15.1	16.1	17.4	18.4	19.3	19.9	20.7	21.0	21.9	21.6	21.5	21.0	20.6	19.5	18.5	17.4	16.7	18.0

PERCENTAGE OF DATA VALID 99.7 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 12958.00 TOTAL MONTHLY RECORD HOURS = 718.00

TABLE: F-65

OWMC AIR POLLUTION SURVEY

MET. DATA TEMPERATURE(30 m)

UNITS DEG. C

STATION LINCOLN COUNTY

MONTH JUL 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	16	16	14	14	15	13	14	14	16	18	20	21	21	22	22	23	21	20	19	19	20	20	19	19	18.2
2	19	18	17	16	16	16	16	16	16	16	17	19	21	22	23	24	24	23	21	21	21	21	19	19	19.2
3	19	18	17	16	15	14	14	14	15	15	15	16	17	18	19	20	20	20	20	19	18	16	16	16	17.0
4	15	15	14	13	13	13	13	13	16	19	20	21	21	22	23	22	20	21	23	23	23	24	23	23	18.9
5	23	23	22	21	21	21	21	21	22	22	23	24	25	25	26	26	28	28	28	28	27	26	26	25	24.3
6	23	23	22	22	21	21	21	21	23	24	26	27	28	28	29	30	30	30	30	29	27	26	26	26	25.5
7	25	24	24	24	24	23	22	23	24	25	26	28	29	29	25	26	24	25	28	28	27	25	24	21	25.1
8	20	20	19	19	18	18	19	21	23	23	22	22	21	22	22	22	22	23	24	23	23	22	21	20	21.2
9	20	20	20	20	20	19	18	18	19	20	19	19	20	22	23	24	24	24	23	23	22	20	18	18	20.5
10	16	16	15	14	13	12	12	13	15	17	18	20	21	21	21	22	22	22	****	20	19	19	19	19	17.7
11	18	17	16	16	15	15	15	16	18	18	18	19	18	17	18	18	18	18	18	18	17	17	17	17	17.2
12	16	16	15	15	15	15	15	15	15	15	15	15	15	15	15	16	16	17	17	16	16	16	15	16	15.5
13	16	16	16	16	16	16	17	19	21	22	23	24	25	25	24	26	27	27	25	23	22	19	19	19	21.0
14	19	19	18	18	18	17	17	17	18	18	19	19	19	20	21	22	22	23	23	22	22	20	19	18	19.5
15	17	16	15	14	14	13	13	14	16	19	21	22	23	24	24	24	24	24	23	23	22	20	20	18	19.3
16	18	18	19	18	18	17	17	18	18	19	19	20	20	21	21	22	22	23	23	23	22	22	20	19	19.9
17	19	19	19	20	19	18	18	19	19	20	19	19	20	22	24	25	26	27	27	26	25	24	22	22	21.6
18	22	23	23	23	22	22	22	22	22	23	26	28	29	27	28	29	30	30	30	24	23	23	23	22	24.8
19	21	22	21	21	18	19	19	19	20	21	21	23	23	23	23	24	25	25	25	24	23	22	21	21	21.8
20	21	21	20	20	21	21	20	20	20	21	22	20	22	24	25	25	26	26	25	24	24	21	20	19	22.0
21	18	17	16	16	15	16	16	16	16	16	16	16	16	17	17	18	18	18	18	18	18	17	16	15	16.7
22	16	16	15	16	16	14	15	14	15	17	18	23	23	24	24	24	25	25	24	24	23	22	21	21	19.8
23	21	20	20	19	19	18	18	19	20	22	24	26	17	27	28	28	29	29	29	28	26	24	23	23	23.2
24	23	22	23	22	22	21	21	21	22	23	25	26	27	27	28	29	29	29	29	28	26	24	23	23	24.7
25	23	23	23	23	23	23	23	23	25	26	27	28	28	28	28	29	27	27	26	26	25	25	24	25	25.3
26	25	24	24	24	23	23	23	23	23	23	23	23	24	23	22	23	24	23	23	22	22	22	22	22	23.0
27	21	22	22	21	21	20	21	21	21	22	22	23	23	24	24	25	25	26	26	26	26	25	23	23	23.0
28	22	21	21	21	21	21	21	20	21	21	24	25	26	26	27	27	27	27	26	25	24	24	24	24	23.6
29	23	23	22	22	21	21	20	20	21	21	22	23	23	23	22	25	25	25	25	23	22	21	21	21	22.3
30	20	20	20	20	20	20	20	20	21	21	21	22	22	22	22	23	24	25	24	23	23	22	21	21	21.5
31	20	20	20	20	20	19	19	19	20	21	22	23	23	23	24	25	25	25	24	23	22	22	22	22	21.8
MEAN	19.8	19.6	19.1	18.8	18.5	18.0	18.1	18.4	19.4	20.3	21.1	22.1	22.3	23.0	23.3	24.1	24.2	24.4	24.2	23.3	22.6	21.6	20.9	20.5	21.1

PERCENTAGE OF DATA VALID 99.9

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 15704.00 TOTAL MONTHLY RECORD HOURS = 743.00

TABLE: F-66 OWMC AIR POLLUTION SURVEY

MET. DATA TEMPERATURE(30 m) UNITS DEG. C

STATION LINCOLN COUNTY MONTH AUG 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	22	22	22	22	21	20	20	21	21	****	23	23	24	25	25	25	25	26	25	25	24	23	23	23	23.0
2	23	23	23	22	22	22	22	25	25	25	25	26	26	26	26	26	26	25	24	23	22	22	22	22	23.9
3	21	21	21	21	21	21	21	21	22	23	23	23	24	25	24	23	24	25	25	24	23	23	22	22	22.6
4	22	22	21	21	21	21	21	21	22	23	23	24	24	24	24	25	25	25	25	24	23	23	23	23	22.9
5	23	23	22	22	23	23	23	23	24	25	25	26	26	26	26	26	26	26	25	24	23	22	21	20	23.9
6	20	20	20	20	19	19	19	20	20	21	22	22	25	26	26	26	26	26	27	27	26	23	22	21	22.6
7	21	22	21	19	18	18	19	19	19	20	20	21	23	23	23	23	22	23	22	22	22	22	21	21	21.0
8	20	20	20	****	****	****	20	20	20	20	21	22	24	24	24	25	25	25	24	23	23	21	20	19	21.9
9	19	18	18	18	18	18	18	18	19	20	21	22	22	23	24	24	25	25	24	23	23	22	21	20	21.0
10	19	19	19	19	19	19	19	19	20	20	21	23	24	24	24	24	22	23	22	20	20	20	20	20	20.8
11	18	18	16	15	15	15	16	16	17	17	18	18	19	20	20	20	20	20	20	19	18	16	15	14	17.5
12	13	13	13	12	13	13	14	14	16	18	20	20	21	21	21	21	21	21	20	20	20	18	18	18	17.5
13	18	18	16	15	15	18	17	16	17	18	20	21	22	22	23	24	23	23	23	22	21	20	19	18	19.5
14	18	17	17	17	18	18	18	18	18	20	22	22	23	22	22	24	25	25	25	24	24	23	22	22	21.0
15	23	24	24	24	24	24	24	23	24	24	25	26	26	27	27	28	28	28	27	26	24	23	22	21	24.8
16	21	22	22	22	22	22	21	21	21	22	23	24	26	26	26	26	26	26	26	26	25	24	23	22	23.5
17	22	22	22	21	21	20	20	20	20	20	22	24	26	27	28	28	28	29	28	28	27	26	25	24	24.1
18	22	21	20	20	20	20	20	20	21	22	22	23	23	24	25	26	26	26	26	25	23	22	22	21	22.5
19	20	20	20	19	19	18	18	18	19	20	21	22	22	22	22	22	22	23	23	22	21	20	20	20	20.5
20	18	18	18	18	18	18	18	18	19	21	22	24	24	26	26	26	26	25	24	24	22	22	22	22	21.6
21	22	22	22	22	21	21	21	21	21	22	24	24	24	24	23	23	24	24	24	24	23	23	21	20	22.5
22	19	19	19	19	18	18	16	16	16	17	18	19	20	20	21	21	21	21	20	20	18	17	17	16	18.6
23	16	16	16	16	17	18	20	20	21	23	23	23	24	24	24	22	22	23	23	21	20	17	17	16	20.1
24	14	13	13	13	13	13	13	14	16	16	17	18	20	20	21	22	22	22	21	20	18	16	15	14	16.8
25	13	13	12	10	10	10	10	11	12	16	17	19	20	20	20	19	20	20	20	20	19	18	18	18	16.0
26	18	18	18	18	17	18	18	18	19	21	22	23	24	24	24	24	24	23	21	20	20	21	22	23	20.8
27	23	22	21	20	19	18	16	14	14	16	16	18	18	18	18	18	17	16	14	13	12	12	11	10	16.4
28	10	9	8	8	8	8	8	6	8	10	12	14	14	15	15	15	15	13	13	13	12	10	8	8	10.8
29	7	6	5	5	5	5	5	5	7	10	13	****	16	16	16	17	16	17	16	16	14	14	13	12	11.1
30	12	12	12	12	12	12	12	12	14	17	18	18	19	20	20	20	20	20	19	18	16	16	16	16	16.0
31	14	14	15	15	14	14	14	14	15	18	19	20	21	21	22	22	21	20	19	18	16	16	16	15	17.2
MEAN	18.4	18.3	17.9	17.5	17.4	17.4	17.5	17.5	18.3	19.5	20.6	21.7	22.4	22.7	22.9	23.1	23.0	23.0	22.4	21.7	20.7	19.8	19.3	18.7	20.1

PERCENTAGE OF DATA VALID 99.3 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 14842.00 TOTAL MONTHLY RECORD HOURS = 739.00

TABLE: F-67 OWMC AIR POLLUTION SURVEY

MET. DATA TEMPERATURE(30 m) UNITS DEG. C

STATION LINCOLN COUNTY MONTH SEP 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	15	15	14	15	15	15	14	15	16	18	20	22	22	23	23	23	24	23	23	22	21	21	20	20	19.1
2	19	18	17	16	16	16	16	15	15	18	21	22	23	23	24	24	24	24	23	22	22	21	20	19	19.9
3	18	18	17	17	16	16	15	15	16	18	20	22	23	24	24	23	23	23	24	23	21	21	20	19	19.8
4	19	19	20	20	20	20	20	21	21	21	22	22	23	22	23	23	22	23	23	23	22	22	20	22	21.4
5	22	20	15	13	12	11	11	11	17	19	21	22	22	23	23	22	22	22	21	20	19	18	17	17	18.3
6	16	15	15	14	13	12	11	11	12	13	14	15	16	16	17	18	18	18	17	16	15	14	13	13	14.7
7	13	11	11	10	10	9	8	9	10	12	13	13	14	14	15	15	15	14	14	12	11	9	8	8	11.6
8	7	7	7	7	7	7	6	7	8	12	15	16	17	17	17	18	18	17	17	16	15	14	14	14	12.5
9	14	14	13	13	12	12	12	11	12	15	18	19	20	20	20	20	20	20	20	19	18	17	16	16	16.3
10	16	15	14	15	16	16	16	16	17	19	19	20	19	18	18	20	21	21	21	21	22	24	24	24	18.8
11	24	24	24	21	20	20	20	20	20	21	22	22	21	21	22	22	24	23	23	24	23	23	21	21	21.9
12	20	20	20	20	20	20	20	19	18	18	18	18	18	18	17	16	15	15	15	14	13	12	11	11	16.9
13	10	10	11	11	11	11	10	10	12	14	16	18	17	17	18	18	19	19	17	15	12	10	9	9	13.5
14	7	6	5	6	5	4	4	5	6	9	11	13	14	14	15	15	15	15	14	13	12	11	10	9	9.9
15	9	9	9	8	9	8	8	8	8	8	9	9	9	9	8	9	9	10	10	9	8	9	7	7	8.6
16	6	6	5	5	4	3	4	5	7	8	9	9	9	10	10	11	11	11	10	10	10	10	9	9	8.0
17	9	9	9	8	7	7	6	5	6	9	11	12	12	13	14	14	15	14	13	12	11	10	10	10	10.3
18	10	11	12	13	13	13	13	13	13	13	15	16	17	17	18	17	17	16	16	16	16	16	16	16	14.7
19	16	15	15	15	14	15	15	15	15	16	16	16	17	17	18	18	18	18	18	18	18	17	16	16	16.3
20	17	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	15	15	15	14	14	15.8
21	14	13	13	13	12	12	12	12	12	12	13	13	13	14	15	16	16	15	14	13	13	13	13	13	13.3
22	13	13	13	13	13	13	13	13	14	15	16	16	16	16	16	17	20	21	21	19	15	12	18	19	15.6
23	20	21	18	16	18	19	20	19	18	18	18	19	21	21	21	22	22	22	21	20	19	18	18	18	19.5
24	18	18	18	17	17	17	17	17	17	17	18	20	21	22	22	22	22	22	21	19	18	17	17	17	18.8
25	17	16	16	16	16	15	15	15	15	16	18	19	19	19	19	18	17	19	20	19	19	17	17	17	17.3
26	18	18	18	18	18	18	16	16	16	18	21	23	24	24	23	22	22	23	21	20	20	19	19	18	19.7
27	18	18	18	16	16	15	15	14	14	13	14	14	15	15	15	****	****	****	****	****	****	****	****	****	15.3
28	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	22	22	22	22	22	****	****	****	****	****
29	17	19	20	21	20	21	22	21	21	20	21	22	22	21	23	25	27	28	25	24	25	25	28	28	22.8
30	26	25	25	23	22	21	21	21	21	21	21	20	21	22	23	23	23	21	20	21	21	21	18	16	21.5
MEAN	15.4	15.1	14.8	14.3	14.1	13.9	13.7	13.6	14.2	15.4	16.8	17.5	18.0	18.1	18.5	18.9	19.2	19.1	18.6	17.8	16.9	16.3	15.8	15.7	16.3

PERCENTAGE OF DATA VALID 96.1 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 11301.00 TOTAL MONTHLY RECORD HOURS = 692.00

TABLE: F-68 OWMC AIR POLLUTION SURVEY

MET. DATA TEMPERATURE(30 m) UNITS DEG. C

STATION LINCOLN COUNTY MONTH OCT 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	15	15	14	14	14	14	14	13	14	15	16	16	17	17	17	17	17	16	16	15	15	15	15	15	15.3
2	13	12	12	12	13	****	****	****	13	13	14	14	15	16	16	17	18	18	16	15	15	15	15	15	14.6
3	15	14	14	14	14	14	14	15	16	16	16	18	18	19	****	****	****	****	****	****	****	23	22	20	16.6
4	20	19	17	15	15	14	14	14	14	14	15	14	14	14	13	13	13	13	13	12	12	12	12	11	14.0
5	11	11	10	10	10	10	9	9	9	9	10	10	11	13	13	13	13	13	13	13	14	14	11	10	11.2
6	9	8	7	7	7	7	7	7	7	7	8	8	8	9	9	9	10	9	9	7	7	6	6	6	7.7
7	6	6	6	7	7	6	7	7	7	9	11	12	13	14	14	14	14	14	13	13	13	14	14	14	10.6
8	14	14	14	14	14	14	14	14	14	15	15	15	15	15	16	17	17	16	17	17	18	18	18	17	15.5
9	17	15	14	12	10	9	9	8	7	8	7	8	8	8	8	8	8	7	7	7	5	5	5	5	8.5
10	5	5	4	5	5	4	4	4	4	4	5	6	6	7	7	8	8	9	8	7	4	4	4	3	5.4
11	3	2	2	2	3	5	5	6	7	10	11	12	13	13	14	15	16	16	15	15	13	13	13	12	9.8
12	12	12	12	12	12	12	12	12	13	14	15	16	16	17	17	18	18	18	18	17	18	17	17	17	15.1
13	16	15	15	14	13	14	14	14	14	15	15	15	15	16	17	17	17	17	16	15	14	14	13	13	14.9
14	15	15	15	14	16	15	16	14	13	13	13	12	11	11	11	10	10	9	8	7	7	7	6	5	11.4
15	5	5	5	5	5	4	4	4	5	6	8	9	9	10	10	10	10	10	8	8	8	7	7	6	7.0
16	5	5	5	5	5	6	6	7	7	8	8	8	9	10	10	10	10	9	8	7	7	7	7	7	7.3
17	7	7	7	7	7	7	7	7	7	7	7	7	7	8	8	8	8	8	8	7	7	6	6	6	7.1
18	6	6	5	4	4	5	5	5	5	5	7	8	8	8	9	10	10	10	9	8	8	8	7	7	7.0
19	6	5	5	5	4	5	4	4	3	4	8	10	11	12	13	13	13	12	11	10	9	8	7	7	7.9
20	7	7	7	6	6	5	5	5	5	7	10	13	15	16	15	15	15	14	13	11	11	11	11	10	10.0
21	10	10	11	12	12	13	13	13	13	14	15	16	16	15	16	17	18	16	14	13	13	11	10	10	13.4
22	11	11	11	10	9	10	9	8	8	9	10	12	14	15	14	16	15	15	15	14	15	15	15	15	12.3
23	14	14	14	14	14	14	14	13	14	14	14	14	15	16	16	15	15	15	15	12	10	9	8	7	13.3
24	7	7	7	7	7	6	7	6	6	7	8	9	10	10	10	9	9	8	7	7	6	6	5	4	7.3
25	4	4	4	4	3	3	3	3	4	4	6	8	9	10	11	11	11	10	10	10	10	10	10	10	7.2
26	10	10	10	10	10	10	10	10	10	10	11	11	12	13	13	12	12	12	12	11	11	11	****	****	11.0
27	11	11	11	12	****	****	****	****	****	****	14	14	14	14	****	****	****	****	12	****	9	****	****	****	****
28	11	10	10	9	9	9	9	9	9	10	11	12	13	13	14	14	13	13	13	12	13	13	14	13	11.5
29	13	13	13	12	12	12	12	12	13	14	14	14	15	15	15	13	13	13	13	12	11	11	10	9	12.7
30	8	8	7	6	5	5	6	6	6	6	6	5	6	6	6	6	5	5	4	4	4	4	3	3	5.4
31	3	3	3	2	2	2	3	2	4	6	8	8	9	10	12	13	13	13	13	13	13	13	13	12	8.0
MEAN	10.0	9.6	9.4	9.1	8.9	8.8	8.8	8.7	9.0	9.8	10.8	11.4	12.0	12.6	12.6	12.7	12.7	12.3	11.8	11.0	10.7	10.9	10.5	10.0	10.6

PERCENTAGE OF DATA VALID 96.5 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 7597.00 TOTAL MONTHLY RECORD HOURS = 718.00

TABLE: F-69 OWMC AIR POLLUTION SURVEY

MET. DATA TEMPERATURE(30 m) UNITS DEG. C

STATION LINCOLN COUNTY MONTH NOV 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	12	12	12	12	13	13	13	13	13	14	15	15	16	17	17	17	16	15	13	10	9	8	0	6	12.5
2	7	6	5	4	4	4	4	4	4	4	5	5	5	6	6	6	6	5	4	3	2	1	1	1	4.3
3	0	0	0	1	1	1	1	2	3	3	4	6	7	7	7	7	7	7	7	8	8	8	7	6	4.5
4	6	6	6	6	6	6	5	3	4	4	3	3	3	3	3	2	2	1	0	0	0	0	-1	-1	2.9
5	-1	-1	-1	-1	-1	-1	-1	0	0	2	3	4	5	5	6	6	7	7	7	7	7	7	7	7	3.3
6	7	7	7	6	6	6	6	6	6	6	7	8	10	11	11	11	10	9	8	8	7	8	8	8	7.8
7	8	7	7	8	7	6	5	6	7	9	10	11	11	10	9	9	9	9	9	9	9	8	0	8	8.0
8	8	8	9	9	9	10	9	5	11	12	13	13	14	16	17	18	17	17	17	17	16	16	14	14	12.9
9	14	12	11	11	11	10	10	10	10	11	12	12	12	12	11	10	9	4	2	0	0	0	0	-1	8.0
10	-1	-1	-1	-2	-2	-2	-2	-2	-1	-1	1	1	2	2	2	2	2	1	1	1	0	1	0	0	0.0
11	1	2	3	3	2	1	0	0	0	1	1	1	1	2	3	3	3	2	2	1	1	1	0	-1	1.4
12	-1	-1	-2	-1	-1	-1	-1	-1	-1	-1	0	1	1	1	1	2	2	2	2	1	0	0	-2	-2	-0.1
13	-3	-4	-4	-5	-6	-6	-7	-7	-6	-6	-5	-5	-5	-5	-5	-5	-5	-6	-7	-7	-8	-8	-9	-9	-6.0
14	-9	-10	-10	-10	-11	-11	-11	-10	-8	-7	-6	-5	-2	-2	-1	-1	-1	-1	0	0	0	1	1	1	-4.7
15	2	2	2	2	2	1	1	1	1	2	2	3	3	4	5	5	5	5	5	5	5	5	2	2	3.0
16	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	3	3	2	1.5
17	2	2	3	3	3	5	6	6	6	7	8	9	9	9	9	9	8	7	6	5	4	3	3	2	5.6
18	1	1	1	0	0	1	1	1	1	1	2	2	2	2	3	3	2	1	0	1	1	0	0	-1	1.1
19	-2	-2	-4	-5	-6	-6	-7	-7	-6	-6	-6	-5	-5	-5	-4	-4	-5	-5	-6	-6	-6	-6	-6	-6	-5.3
20	-5	-5	-5	-5	-5	-4	-4	-3	-4	-3	-2	-1	-1	-1	-1	0	0	0	-1	-1	-1	0	0	0	-2.2
21	0	0	-1	-2	-2	-2	-2	-2	-2	-2	-1	-1	0	0	1	1	0	0	0	-1	-2	-3	-4	-5	-1.3
22	-5	-5	-5	-5	-3	-3	-2	-3	-2	-2	0	2	3	5	6	6	5	4	4	4	4	3	4	4	0.8
23	3	3	2	1	3	4	5	5	6	6	7	8	9	10	10	9	9	9	9	9	9	9	7	7	6.6
24	8	7	7	6	4	4	4	4	3	4	4	4	4	4	4	3	3	3	3	3	2	2	2	1	3.9
25	1	1	1	1	2	3	3	2	3	3	4	5	6	6	7	7	6	5	5	5	5	5	4	4	3.9
26	5	5	5	6	6	5	5	4	3	-3	-3	-1	-2	-1	-4	-7	-2	4	4	4	4	4	5	5	2.1
27	4	4	3	3	3	3	3	2	2	2	4	5	6	5	5	5	5	4	3	4	5	5	6	6	4.0
28	6	6	5	3	2	1	1	1	1	2	4	5	5	5	4	4	4	4	4	4	4	4	4	4	3.6
29	4	4	3	2	2	2	2	1	1	2	3	5	6	6	6	6	5	5	4	3	3	2	2	2	3.4
30	1	1	1	0	0	-1	-1	-2	-2	-2	-2	-2	-2	-2	-3	-3	-4	-5	-5	-5	-5	-5	-5	-5	-2.4
MEAN	2.5	2.3	2.1	1.7	1.7	1.7	1.6	1.3	1.8	2.1	2.9	3.6	4.1	4.4	4.5	4.4	4.2	3.8	3.4	3.1	2.8	2.7	1.8	2.0	2.8

PERCENTAGE OF DATA VALID 100.0 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 1999.00 TOTAL MONTHLY RECORD HOURS = 720.00

TABLE: F-70 OWMC AIR POLLUTION SURVEY

MET. DATA TEMPERATURE(30 m) UNITS DEG. C

STATION LINCOLN COUNTY MONTH DEC 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	-5	-5	-5	-5	-4	-4	-4	-5	-5	-4	-4	-3	-2	-1	-1	-1	-1	-2	-2	-1	-1	-1	-1	0	-2.8
2	0	0	0	-1	0	0	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	1.1
3	2	2	2	2	2	2	2	2	4	4	5	5	4	4	4	4	4	3	2	2	2	1	1	0	2.7
4	1	0	0	-1	0	0	-1	-1	0	0	0	1	1	2	1	-1	-1	-1	-1	-2	-2	-2	-2	-2	-0.5
5	-3	-3	-4	-4	-4	-4	-3	-3	-3	-2	-2	-1	0	0	0	0	0	0	0	-1	-2	-2	-2	-1	-1.8
6	0	0	0	0	0	0	0	1	1	1	2	1	1	0	0	0	0	0	0	0	0	0	-1	-1	0.2
7	-2	-2	-2	-1	-1	-1	-1	1	2	3	2	2	3	3	3	3	2	2	1	1	2	1	1	1	1.0
8	1	1	1	1	-1	-2	-3	-3	-4	-5	-6	-6	-6	-5	-6	-6	-7	-7	-6	-6	-6	-5	-5	-5	-4.0
9	-5	-4	-5	-5	-4	-4	-3	-3	-2	-1	0	1	1	2	1	1	1	1	1	2	2	2	2	2	-0.7
10	1	1	1	1	1	1	2	1	-2	-3	-3	-4	-4	-5	-5	-5	-5	-6	-6	-5	-5	-5	-6	-7	-2.8
11	-7	-8	-7	-7	-7	-7	-7	-6	-6	-4	-3	-3	-2	-2	-2	-2	-1	-1	-1	-1	0	0	0	0	-3.5
12	0	0	0	0	0	0	0	-1	-1	-1	-2	-1	-1	-1	-2	-2	-4	-4	-6	-6	-7	-7	-7	-7	-2.5
13	-7	-8	-9	-10	-11	-11	-12	-12	-12	-11	-10	-8	-7	-7	-6	-6	-6	-7	-7	-7	-7	-7	-6	-5	-8.3
14	-4	-3	-3	-3	-3	-3	-3	-3	-2	-2	-1	-1	1	1	2	2	2	1	2	2	3	2	2	2	-0.4
15	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	0	0	1	1	1	1	1.6
16	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.0
17	1	1	1	1	1	1	2	2	2	2	3	3	4	4	5	5	****	5	5	5	5	3	3	3	2.9
18	3	3	4	4	4	4	5	5	4	4	3	3	3	2	2	1	1	1	0	0	1	1	2	2	2.6
19	2	2	2	2	2	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0.8
20	0	0	0	0	0	-1	-1	-1	-1	0	0	1	2	2	2	2	2	2	1	1	1	0	0	0	0.5
21	0	-1	-1	-1	-1	-2	-3	-3	-3	-2	-1	-1	0	0	1	1	0	0	-1	-1	-2	-2	-2	-2	-1.1
22	-2	-2	-2	-2	-2	-2	-2	-2	-1	0	1	1	2	2	2	1	1	1	1	1	1	1	1	1	0.0
23	1	1	2	1	1	1	1	0	-1	-1	-1	0	0	0	0	1	1	0	0	0	0	1	1	1	0.4
24	1	1	1	1	0	-1	-1	-1	0	0	1	2	3	3	2	1	1	1	1	****	****	****	****	****	0.8
25	****	****	****	****	****	****	****	****	****	****	****	2	3	3	3	3	2	2	1	1	1	1	1	1	1.8
26	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0.7
27	0	0	0	1	0	0	0	0	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0.3
28	0	0	0	0	-1	-1	0	-1	-1	0	1	1	2	1	1	1	1	1	1	1	1	1	1	1	0.5
29	1	1	1	1	1	1	0	0	0	1	1	1	0	0	0	0	0	0	-1	-1	-1	-1	-1	-2	0.1
30	-2	-2	-2	-2	-2	-1	-1	-1	-1	0	1	1	1	0	0	1	1	1	1	1	0	0	0	0	-0.3
31	-1	-1	-1	-1	-1	0	0	-1	-1	-1	0	0	1	1	1	1	1	1	1	1	1	2	2	2	0.3
MEAN	-0.7	-0.7	-0.8	-0.8	-0.9	-1.0	-0.9	-1.0	-0.9	-0.5	-0.2	0.1	0.5	0.5	0.5	0.4	0.0	0.0	-0.3	-0.3	-0.3	-0.4	-0.4	-0.4	-0.3

PERCENTAGE OF DATA VALID 97.7 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= -252.00 TOTAL MONTHLY RECORD HOURS = 727.00

TABLE: F-71

OWMC AIR POLLUTION SURVEY

MET. DATA TEMPERATURE(30 m)

UNITS DEG. C

STATION LINCOLN COUNTY

MONTH JAN 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	1	1	1	0	0	-1	-1	-1	-2	-1	-1	0	0	1	1	0	0	0	0	0	0	0	0	0	-0.1
2	0	0	0	0	0	0	-1	-1	-2	-2	-2	-2	-3	-2	-3	-3	-3	-3	-2	-2	-2	-2	-2	-2	-1.6
3	-2	-3	-2	-2	-2	-3	-4	-5	-6	-6	-5	-5	-5	-3	-3	-3	-3	-4	-4	-6	-7	-8	-9	-8	-4.5
4	-9	-9	-9	-9	-11	-11	-10	-8	-8	-7	-7	-6	-5	-4	-3	-2	-3	-3	-4	-4	-4	-5	-5	-4	-6.3
5	-4	-5	-5	-5	-7	-7	-5	-8	-8	-7	-5	-3	-1	0	0	1	0	0	0	-1	-1	-1	-1	-1	-3.1
6	-2	-2	-2	-2	-2	-2	-3	-3	-2	-1	0	0	1	2	2	3	3	4	5	5	6	7	7	6	1.3
7	6	5	4	4	4	4	2	2	2	2	2	2	2	2	1	1	1	0	0	-1	-1	-1	-1	-1	1.7
8	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-1	-2	-1	-1	-1	0	0	-1	0	0	-1	-1.4
9	-1	-1	-1	-1	-1	-2	-2	-2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1.1
10	-1	-1	-2	-2	-1	-1	-1	-1	0	0	0	1	2	2	1	1	1	1	1	1	1	1	0	0	0.1
11	0	-1	-1	-1	-1	-2	-2	-2	-2	-2	-2	-3	-2	-2	-1	-2	-2	-2	-2	-2	0	0	0	0	-1.4
12	-1	-1	-1	-2	-2	-2	-1	-1	-1	-1	-1	0	1	1	2	2	1	1	1	1	1	1	1	1	0.0
13	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	1	1	0	0	0	0	1	1	1.1
14	2	3	3	4	4	5	5	4	4	4	5	5	6	6	5	5	5	5	5	6	****	****	****	****	4.6
15	****	****	****	****	5	4	4	4	4	4	4	4	4	****	4	3	3	3	2	2	****	****	****	****	3.6
16	****	****	****	****	-3	-3	-3	-4	-4	-4	-5	-4	****	****	****	****	****	-4	-4	****	****	****	-5	-5	-4.0
17	-5	-5	-5	-6	-6	-6	-7	-7	-7	-6	-5	-5	-4	-4	-4	-4	-4	-4	-4	-4	-4	-5	-4	-4	-5.0
18	-4	-3	-3	-2	-1	-2	-1	-1	-1	-2	-1	0	0	-1	0	0	-1	-1	-1	-1	-2	-2	-2	-2	-1.4
19	-4	-3	-3	-2	-2	-3	-3	-5	-5	-5	-6	-7	-3	-4	-4	-4	-4	-4	-5	-6	-6	-6	-7	-7	-4.5
20	-7	-8	-8	-9	-10	-10	-10	-11	-11	-10	-8	-6	-4	-3	-2	-3	-3	-2	-2	-2	-2	-2	****	****	-6.0
21	DATA MISSING																								
22	DATA MISSING																								
23	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	-13	-15	-15	-16	-16	-16	-16	-16	-16	****
24	-16	-16	-16	-16	-16	-17	-18	-18	-18	-17	-16	-15	-14	-14	-14	-14	-14	-15	-16	-16	-16	-16	-16	-16	-15.8
25	-16	-16	-16	-16	-16	-16	-16	-16	-15	-14	-12	-10	-10	-9	-9	-9	-9	-9	-10	-10	-10	-10	-10	-10	-12.3
26	-10	-10	-10	-9	-8	-8	-8	-8	-8	-8	-7	-7	-7	-7	-7	-8	-8	-8	-9	-9	-10	-11	-12	-13	-8.8
27	-13	-13	-15	-15	-15	-14	-12	-12	-13	-12	-11	-8	-6	-5	-5	-5	-5	-6	-6	-6	-6	-6	-5	-5	-9.1
28	-5	-5	-5	-5	-5	-5	-5	-5	-5	-4	-5	-4	-4	-4	-3	-3	-3	-3	-4	-4	-4	-4	-3	-3	-4.2
29	-3	-3	-3	-3	-4	-4	-4	-4	-4	-4	-3	-3	-3	-3	-2	-2	-2	-4	-4	-4	-3	-3	-4	-4	-3.3
30	-4	-3	-3	-2	-2	-2	-1	-1	0	0	1	-3	-1	-1	-2	-1	0	0	0	-1	-1	-1	-2	-2	-1.3
31	-3	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-3	-3	-3	-3	-3	-5	-6	-6	-7	-7	-8	-8	-4.5
MEAN	-3.9	-4.0	-4.1	-4.1	-3.8	-4.0	-4.0	-4.3	-4.2	-3.9	-3.4	-3.0	-2.2	-2.1	-1.9	-2.3	-2.5	-2.7	-3.0	-3.1	-3.7	-3.8	-4.0	-4.0	-3.4

PERCENTAGE OF DATA VALID 87.9

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= -2228.00 TOTAL MONTHLY RECORD HOURS = 654.00

TABLE: F-72 OWMC AIR POLLUTION SURVEY

MET. DATA TEMPERATURE(30 m) UNITS DEG. C

STATION LINCOLN COUNTY MONTH FEB 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	-9	-8	-7	-6	-6	-6	-6	-4	-3	-1	-1	0	1	2	3	3	3	3	3	3	3	2	2	1	-1.2
2	1	2	2	0	-1	-2	-3	-1	0	1	2	2	2	2	2	1	0	-1	-2	-2	-3	-4	-2	-3	-0.3
3	-4	-5	-3	0	3	2	2	2	2	2	2	2	2	3	3	3	2	2	1	1	0	0	0	0	0.9
4	0	-1	0	0	0	-1	-1	-1	-1	-2	-2	-2	-1	-1	-2	-2	-2	-2	-4	-5	-5	-6	-7	-8	-2.3
5	-8	-8	-8	-8	-8	-8	-8	-8	-7	-7	-6	-5	-4	-2	-2	****	****	****	****	****	****	****	****	****	-6.5
6	****	****	****	****	-4	-4	-5	-4	-3	-4	-3	****	****	****	****	2	2	2	1	2	2	2	2	0	-0.8
7	0	0	0	-1	0	0	0	0	1	2	3	4	4	3	4	2	2	2	0	1	0	0	1	1	1.2
8	2	3	3	5	5	5	6	6	5	3	3	4	3	2	0	-3	-5	-7	-8	-8	-8	-10	-11	-11	-0.7
9	-11	-12	-13	-14	-14	-14	-15	-13	-13	-12	-12	-11	-10	-8	-7	-8	-8	-8	-7	-7	-7	-6	-5	-3	-9.9
10	-3	-2	-2	-3	-3	-2	-2	-2	-1	-1	0	1	2	2	2	1	2	1	0	1	-2	-2	-3	-4	-0.8
11	-4	-5	-7	-6	-6	-7	-7	-7	-7	-6	-3	-2	-1	-1	0	0	0	0	0	-2	-2	-2	-2	-3	-3.3
12	-2	-3	-2	-2	-3	-3	-3	-3	-3	-2	-1	0	-1	-1	-1	-1	-1	-1	-1	0	1	1	-2	-4	-1.6
13	-6	-8	-9	-9	-10	-10	-10	-11	-11	-11	-11	-11	-11	-10	-9	-8	-9	-9	-9	-9	-9	-9	-10	-9	-9.5
14	-9	-10	-10	-10	-11	-11	-11	-11	-11	-11	-12	-12	-11	-10	-10	-11	-11	-12	-12	-11	-13	-13	-14	-14	-11.3
15	-14	-15	-16	-16	-16	-16	-17	-17	-17	-17	-16	-16	-16	-15	-15	-15	-14	-14	-15	-14	-15	-13	-14	-14	-15.3
16	-14	-14	-14	-14	-14	-14	-14	-14	-14	-13	-11	-11	-10	-10	-9	-9	-9	-9	-9	-9	-9	-10	-9	-9	-11.3
17	-9	-10	-10	-10	-10	-10	-9	-9	-7	-6	-5	-4	-4	-3	-4	-4	-4	-4	-5	-5	-5	-5	-5	-5	-6.3
18	-5	-5	-5	-4	-4	-5	-4	-6	-5	-3	-3	-3	-3	-3	-3	-2	-2	-3	-3	-3	-4	-4	-5	-6	-3.9
19	-5	-6	-7	-6	-8	-8	-10	-8	-7	-4	-2	-1	0	0	1	1	1	1	-1	-1	-3	-3	-3	-5	-3.5
20	-4	-5	-4	-3	-5	-5	-5	-5	-6	-4	-2	-1	0	1	1	1	1	0	-1	-2	-2	-3	-3	-3	-2.5
21	-3	-4	-4	-3	-4	-4	-4	-7	-5	-3	-2	0	2	3	3	3	2	1	0	0	0	0	0	0	-1.2
22	-1	-2	-2	-1	-1	-2	-2	-1	-1	1	2	3	4	5	5	6	5	3	3	3	3	2	2	2	1.5
23	2	2	2	2	2	1	0	1	1	1	2	2	3	3	2	2	2	2	1	1	2	-1	-1	-2	1.3
24	-3	-3	-4	-4	-5	-5	-6	-6	-5	-3	-3	-2	-2	-2	-1	0	0	-1	-2	-3	-4	-4	-4	-5	-3.2
25	-5	-6	-7	-6	-6	-7	-7	-6	-4	-3	-1	-1	-1	0	-1	0	0	0	0	0	-2	-1	-2	-4	-2.9
26	-3	-4	-4	-4	-5	-3	-5	-3	-2	-1	0	0	0	0	0	0	0	-1	-1	-2	-2	-2	-2	-3	-2.0
27	-3	-3	-3	-3	-4	-4	-4	-4	-2	-2	0	1	2	3	4	4	4	3	1	1	0	1	1	1	-0.3
28	1	1	0	0	1	1	0	0	0	0	0	0	2	2	2	2	2	2	2	2	3	3	****	****	1.2
MEAN	-4.4	-4.9	-5.0	-4.7	-4.9	-5.1	-5.4	-5.1	-4.5	-3.8	-2.9	-2.3	-1.8	-1.3	-1.2	-1.2	-1.4	-1.9	-2.5	-2.5	-3.0	-3.2	-3.7	-4.2	-3.4

PERCENTAGE OF DATA VALID 97.2 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= -2202.00 TOTAL MONTHLY RECORD HOURS = 653.00

TABLE: F-73 OWMC AIR POLLUTION SURVEY

MET. DATA TEMPERATURE(30 m) UNITS DEG. C

STATION LINCOLN COUNTY MONTH MAR 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	1	2	2	2	2	2	2	2	2	4	4	3	4	5	5	6	6	5	5	5	3	3	3	3	3.4
2	2	2	1	1	1	1	1	1	1	1	0	0	0	-1	-1	-1	0	0	-1	0	-1	-1	-1	-2	0.1
3	-2	-2	-3	-2	-3	-2	-3	-3	-3	-2	-2	-2	-2	-2	-4	-4	-4	-5	-6	-6	-7	-6	-7	-7	-3.7
4	-7	-6	-7	-7	-7	-7	-7	-8	-7	-7	-6	-5	-4	-3	-2	-2	-2	-2	-2	-2	-3	-3	-4	-4	-4.8
5	-3	-3	-4	-4	-4	-4	-4	-4	-3	-3	-2	-2	-2	-2	-2	0	0	1	0	-2	-2	-3	-2	-2	-2.3
6	-2	-2	-3	-3	-3	-3	-2	-2	-1	2	4	5	7	8	9	9	10	10	9	8	5	4	3	3	3.1
7	2	3	3	5	5	4	4	4	4	5	6	7	8	10	11	12	11	12	12	12	12	11	11	11	7.7
8	12	11	10	7	7	6	7	6	4	3	4	7	10	13	14	15	15	16	16	14	11	8	7	5	9.5
9	5	4	3	3	2	1	1	0	-2	-5	-7	-8	-8	-7	-7	-7	-7	-7	-7	-7	-7	-8	-8	-9	-3.8
10	-11	-11	-12	-12	-12	-13	-13	-12	-12	-12	-11	-11	-10	-9	-9	-9	-9	-9	-9	-9	-10	-10	-11	-10	-10.7
11	-11	-11	-11	-11	-11	-11	-11	-11	-10	-9	-8	-6	-4	-2	-2	-2	-3	-3	-3	-3	-3	-5	-5	-6	-6.8
12	-6	-6	-5	-5	-4	-4	-5	-4	-3	-3	-1	0	1	1	1	1	0	-1	-2	-1	-2	-2	-3	-3	-2.3
13	-4	-4	-5	-5	-5	-5	-5	-4	-3	-2	-1	-1	-1	-1	0	0	0	0	-1	-2	-2	-2	-2	-3	-2.4
14	-4	-4	-5	-5	-5	-5	-4	-4	-3	-2	-1	-1	0	0	0	0	0	0	-1	-1	-1	-1	-1	-1	-2.0
15	-2	-2	-2	-2	-2	-3	-3	-3	-2	0	0	1	1	1	1	****	****	1	0	-1	-1	-2	-2	-2	-1.1
16	-3	-3	-3	-3	-3	-3	-3	-3	-1	0	0	0	0	0	1	2	2	2	1	0	0	-1	-1	-2	-0.9
17	-2	-1	-2	-2	-2	-2	-2	-2	-2	-1	0	2	2	4	6	6	6	****	5	5	4	4	2	2	1.3
18	2	2	1	1	1	1	0	0	1	3	4	6	6	5	5	5	5	5	3	2	2	3	3	2	2.8
19	2	2	2	1	0	0	0	0	1	2	3	4	5	6	5	8	8	7	6	5	4	3	3	3	3.3
20	3	2	1	0	1	0	0	1	2	3	4	5	6	7	7	7	6	5	4	3	2	2	1	1	3.0
21	0	0	0	0	0	0	0	0	0	2	3	4	5	6	7	7	7	8	8	7	6	5	5	4	3.5
22	2	2	2	2	2	3	2	2	1	4	5	7	8	9	9	9	10	10	11	10	8	7	6	6	5.7
23	5	3	2	2	3	3	3	2	2	4	7	7	10	10	10	12	12	10	8	6	6	6	7	8	6.2
24	7	6	6	6	6	4	4	4	6	8	12	14	16	15	14	15	14	12	9	8	9	10	11	10	9.4
25	13	12	10	10	9	9	9	8	9	9	10	8	8	9	12	13	13	12	11	10	8	8	9	8	9.9
26	7	6	3	3	3	3	3	3	3	4	5	5	6	6	6	5	5	4	5	4	4	4	4	4	4.4
27	4	4	4	4	3	2	2	2	2	1	2	4	6	9	10	10	10	10	9	8	7	7	7	7	5.6
28	7	6	6	6	5	4	4	4	4	5	7	11	12	12	12	11	11	10	10	9	9	8	8	7	7.8
29	5	5	4	3	4	4	4	4	4	8	10	12	15	16	17	16	17	17	17	16	18	18	18	16	11.2
30	17	16	16	16	14	12	10	9	9	10	10	10	10	9	6	3	2	1	1	1	0	-1	-1	-2	7.4
31	-2	-2	-2	-2	-3	-4	-4	-4	-4	-4	-5	-5	-5	-4	-4	-4	-4	-4	-5	-5	-6	-6	-6	-5	-4.1
MEAN	1.2	1.0	0.4	0.3	0.1	-0.2	-0.3	-0.4	0.0	0.9	1.8	2.6	3.5	4.2	4.4	4.8	4.7	4.2	3.6	3.0	2.4	1.9	1.7	1.4	2.0

PERCENTAGE OF DATA VALID 99.6 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 1452.00 TOTAL MONTHLY RECORD HOURS = 741.00

TABLE: F-74 OWMC AIR POLLUTION SURVEY

MET. DATA TEMPERATURE(30 m) UNITS DEG. C

STATION LINCOLN COUNTY MONTH APR 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	-4	-4	-4	-4	-5	-4	-4	-4	-3	0	1	1	1	2	3	3	3	3	3	2	2	3	3	3	-0.1
2	1	2	3	3	2	1	1	1	2	2	2	1	1	1	2	1	1	1	1	1	0	0	0	-1	1.2
3	-2	-2	-2	-2	-2	-2	-3	-3	-2	-1	-1	0	0	0	1	2	1	2	1	1	0	0	0	0	-0.6
4	-1	-1	0	0	0	1	1	0	0	0	0	1	1	1	2	3	3	4	4	5	5	6	7	7	2.0
5	7	7	7	7	7	7	6	7	7	7	8	7	6	7	7	7	7	6	7	6	6	6	6	6	6.7
6	6	6	6	6	6	6	6	6	7	7	7	6	7	7	7	8	8	8	8	8	8	8	9	9	7.1
7	9	9	9	9	9	9	8	8	9	9	10	11	12	13	14	14	14	14	14	12	10	9	8	7	10.4
8	7	6	5	4	4	3	3	3	3	4	5	6	7	8	9	10	10	8	7	6	5	5	4	4	5.7
9	4	3	3	5	5	4	3	2	4	8	10	12	12	13	13	12	12	11	10	9	8	8	8	7	7.8
10	6	6	5	5	5	4	4	4	7	10	12	14	15	16	16	17	17	16	15	14	13	12	11	10	10.6
11	9	7	6	7	8	7	7	7	8	13	16	18	17	14	16	18	17	14	12	11	9	9	7	6	11.0
12	6	7	7	6	7	7	7	7	8	9	8	8	8	9	9	9	8	8	8	8	8	6	6	6	7.5
13	6	7	7	7	7	7	7	8	9	9	10	10	10	11	11	15	16	16	14	12	10	9	9	9	9.8
14	10	11	10	10	8	8	9	9	10	10	13	15	16	16	16	14	13	10	10	10	11	12	11	12	11.4
15	12	12	13	11	9	9	9	9	11	13	14	14	14	16	15	16	17	16	14	14	14	14	13	12	13.0
16	11	11	11	10	9	8	7	7	7	7	8	8	9	11	12	13	14	15	12	11	11	13	14	14	10.5
17	13	14	13	12	12	11	10	10	10	9	10	10	9	11	11	11	11	11	11	9	8	7	7	7	10.3
18	8	8	8	10	9	9	8	6	6	7	10	13	15	16	16	16	17	17	17	16	15	14	13	12	11.9
19	11	11	11	11	11	11	11	9	10	11	14	17	19	19	19	20	21	21	21	20	19	18	17	15	15.3
20	16	17	17	17	16	15	15	16	17	19	21	21	22	23	24	25	25	25	23	21	20	20	21	21	19.9
21	19	19	18	17	16	13	14	14	14	15	18	22	23	24	24	23	23	22	21	21	16	13	12	12	18.0
22	10	9	8	8	7	7	7	6	6	6	7	7	8	8	9	9	10	11	11	10	10	9	8	9	8.3
23	9	9	9	8	8	8	8	9	13	17	18	18	16	15	13	11	11	10	10	10	10	10	10	10	11.3
24	9	9	8	8	8	9	8	7	7	7	7	7	7	8	8	9	10	11	11	10	9	8	7	6	8.3
25	5	4	4	4	4	3	3	4	5	7	9	9	10	9	10	11	12	12	12	11	9	9	8	7	7.5
26	7	8	8	8	8	8	8	8	9	11	13	14	15	15	15	15	15	15	15	13	13	12	11	10	11.4
27	9	9	9	8	8	8	7	7	9	13	14	15	17	18	18	18	15	12	9	7	7	7	7	6	10.7
28	6	6	6	6	5	4	4	5	5	5	6	6	6	6	7	8	7	7	7	6	6	6	5	4	5.8
29	4	3	3	3	3	4	5	6	7	8	9	12	14	17	18	18	18	17	15	13	11	9	8	7	9.7
30	6	6	5	4	4	4	4	4	5	5	6	6	7	7	8	9	9	10	10	9	8	7	6	5	6.4
MEAN	7.3	7.3	7.1	6.9	6.6	6.3	6.1	6.1	7.0	8.2	9.5	10.3	10.8	11.4	11.8	12.2	12.2	11.8	11.1	10.2	9.4	9.0	8.5	8.1	9.0

PERCENTAGE OF DATA VALID 100.0 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 6450.00 TOTAL MONTHLY RECORD HOURS = 720.00

TABLE: F-75 OWMC AIR POLLUTION SURVEY

MET. DATA TEMPERATURE(30 m) UNITS DEG. C

STATION LINCOLN COUNTY MONTH MAY 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	4	3	2	2	2	2	1	2	6	9	10	11	12	13	12	12	12	12	12	11	10	9	8	8	7.7
2	7	7	7	7	6	6	5	5	7	11	13	12	14	13	14	14	14	14	14	13	12	11	8	7	10.0
3	6	5	4	4	3	3	4	5	5	6	7	7	8	9	10	10	10	10	10	10	9	8	7	5	6.9
4	5	4	5	5	5	4	4	5	6	7	8	9	10	11	11	11	11	12	12	12	11	9	7	7	8.0
5	7	7	7	6	5	5	5	5	8	11	13	14	15	15	16	17	17	18	18	15	13	12	11	10	11.3
6	9	9	8	8	7	6	5	6	9	13	16	18	19	18	17	18	18	18	18	17	15	13	12	11	12.8
7	11	12	12	10	9	8	9	10	11	11	12	13	14	15	15	15	15	14	14	13	12	12	11	9	12.0
8	8	7	7	7	7	5	4	3	7	10	12	13	13	13	14	15	14	14	15	17	15	12	11	11	10.6
9	11	10	10	10	10	10	11	11	13	15	16	18	19	20	20	21	22	22	23	21	21	20	18	18	16.3
10	18	18	17	17	16	15	14	15	17	20	22	22	22	23	24	24	24	23	23	20	18	17	17	14	19.2
11	14	15	16	15	16	16	16	17	17	19	21	23	25	25	26	27	27	26	25	23	21	20	21	17	20.3
12	17	17	14	12	12	11	10	9	9	9	10	10	11	12	13	14	14	14	14	14	13	12	12	11	12.3
13	9	8	8	7	6	7	6	8	11	12	14	16	16	16	16	17	17	16	16	14	12	11	11	12	11.9
14	14	15	15	14	14	14	13	14	16	17	19	21	22	23	25	26	26	26	26	23	****	18	17	16	18.9
15	16	16	15	13	13	13	12	12	10	10	11	11	12	13	14	15	15	15	14	14	12	11	9	8	12.7
16	8	7	7	7	6	6	5	5	8	11	13	14	15	16	16	17	18	18	17	15	13	12	12	12	11.6
17	13	12	13	13	13	13	13	15	17	19	21	21	22	23	23	24	25	24	24	22	22	20	17	16	18.5
18	16	16	16	12	10	11	11	12	12	11	10	11	12	12	11	11	10	10	11	11	11	12	11	10	11.7
19	10	10	10	10	10	10	10	10	10	11	12	14	15	16	17	17	17	16	15	15	15	15	15	15	13.1
20	14	14	14	13	13	13	13	13	13	13	14	14	15	15	16	17	17	17	16	15	16	15	14	14	14.5
21	13	13	13	13	13	13	13	13	14	14	15	17	19	21	22	24	25	24	23	22	22	22	22	21	18.0
22	19	18	18	17	18	17	17	18	19	19	22	23	24	22	22	23	24	25	25	24	22	18	17	17	20.3
23	18	18	18	17	17	16	16	16	17	18	18	19	18	18	18	18	18	17	16	16	15	14	14	13	16.8
24	12	11	9	8	7	7	7	8	9	10	10	11	11	11	12	12	12	12	12	12	12	12	11	11	10.4
25	11	10	10	10	9	9	8	9	11	12	13	13	13	14	15	15	15	15	15	15	14	12	12	12	12.2
26	12	11	11	10	10	10	10	11	12	14	15	15	16	20	23	24	23	21	21	22	22	21	20	20	16.4
27	19	18	18	18	18	18	17	18	19	21	22	22	24	24	26	27	27	27	27	26	24	21	20	20	21.7
28	20	20	21	21	21	20	20	21	23	24	26	27	28	29	29	27	26	28	29	27	26	25	24	24	24.4
29	23	23	22	21	21	20	20	21	23	26	29	30	31	31	30	30	29	29	28	27	26	25	24	23	25.5
30	23	22	21	21	21	20	20	22	24	26	27	29	29	29	30	30	30	29	28	25	24	25	25	24	25.2
31	23	22	20	19	19	19	19	20	20	20	21	21	22	22	23	22	22	22	24	22	21	20	19	19	20.9
MEAN	13.2	12.8	12.5	11.8	11.5	11.2	10.9	11.6	13.0	14.5	15.9	16.7	17.6	18.1	18.7	19.2	19.2	19.0	18.9	17.8	16.6	15.6	14.7	14.0	15.2

PERCENTAGE OF DATA VALID 99.9 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 11304.00 TOTAL MONTHLY RECORD HOURS = 743.00

TABLE: F-76 OWMC AIR POLLUTION SURVEY

MET. DATA TEMP. DIFF.(30m-10 m) UNITS 0.1 DEG. C

STATION LINCOLN COUNTY MONTH JUN 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	-8	-7	-10	-2	-7	0	5	15	10	0	0	0	-5	-5	-35	5	-40	-50	-20	-20	-10	-10	-17	-25	-9.8
2	-25	-10	-12	-15	-13	-5	-15	-15	-10	-2	-8	-5	-5	-5	5	****	****	-5	-10	-15	-20	-5	-5	-10	-9.5
3	-10	10	5	23	25	8	18	10	0	0	-10	-7	-5	-5	-5	-10	-7	-5	-8	-25	-15	-15	-5	10	-1.0
4	10	15	5	0	0	-2	-2	0	0	0	-5	-5	-5	0	-10	-5	-5	-10	-5	-25	-30	-20	-5	-5	-4.5
5	-5	0	5	5	0	-10	-10	-10	-30	-5	-20	-10	-10	-10	-10	-10	-15	-10	-5	0	-10	-5	-5	-5	-7.7
6	-5	0	-5	-10	-10	-10	-10	-5	-15	-5	0	-5	0	0	5	5	0	-10	-15	-20	-25	-25	-10	-5	-7.5
7	-5	-15	-10	-5	-5	-10	-5	0	5	-5	5	15	10	10	5	10	0	-10	-20	-20	-10	-5	-15	-10	-3.8
8	0	0	0	-5	-10	-15	0	0	0	0	5	-5	-20	0	10	5	0	0	-10	-15	-20	-35	-30	-20	-6.9
9	-10	-5	-15	-10	5	5	5	-15	-5	-10	-10	-10	****	****	0	-5	5	-10	-5	-15	-5	0	-10	15	-4.8
10	20	10	20	25	25	20	25	15	5	10	0	0	5	5	0	-5	-10	-10	-5	-10	-10	-20	-10	-5	4.2
11	-10	-5	-19	-10	-10	-5	-5	-5	-15	-10	-10	-20	15	0	-15	-10	-10	-20	-15	-5	-10	-10	-25	-25	-10.6
12	-25	-25	-35	-35	-10	-10	-5	-5	-5	0	-5	-5	0	0	-5	-5	0	-25	-15	-5	-15	-20	-10	-20	-11.9
13	-15	-15	-10	-10	-10	-15	-10	-10	-10	-10	-10	-5	-5	-10	-10	-10	-10	-10	-5	-10	-10	-15	5	-5	-9.4
14	10	25	15	5	0	5	5	5	10	5	0	-10	-5	-5	5	10	-20	-5	-5	-10	-15	-20	-10	-15	-0.8
15	-5	-5	-5	-5	0	0	0	-10	-10	-5	-10	-10	-5	0	-10	0	-5	-5	-5	-5	-10	-5	-10	-15	-5.8
16	-10	0	-5	-10	-5	-5	0	-5	0	-10	-10	-10	-10	-10	-10	5	****	-25	-5	-5	-15	-5	-5	0	-6.7
17	0	0	0	0	-5	0	-5	5	-5	-5	-5	0	0	5	10	0	0	0	0	0	-5	-5	5	0	-0.4
18	5	0	0	5	5	15	5	5	0	10	0	0	0	5	-10	5	0	0	-5	0	5	0	0	5	2.3
19	5	10	10	10	10	0	5	5	5	5	0	0	0	0	0	-5	0	5	5	0	0	0	0	0	2.9
20	0	-5	5	5	-5	-5	0	0	0	0	0	5	5	0	0	0	0	0	0	0	0	10	25	35	3.1
21	20	15	5	15	25	30	10	10	10	0	5	0	0	0	0	0	5	0	0	0	0	0	10	20	7.5
22	40	20	10	10	5	15	5	10	0	10	5	15	5	5	5	5	5	0	5	10	5	0	-5	5	7.9
23	0	0	0	10	0	0	0	0	10	15	10	10	20	5	20	15	20	20	15	20	15	10	20	20	10.6
24	20	20	20	15	20	15	15	15	20	15	15	10	15	10	15	15	15	15	15	15	10	15	10	10	15.0
25	20	16	11	21	31	17	0	-30	-18	-12	2	0	2	0	-5	-5	3	13	20	25	23	21	40	37	9.7
26	22	12	12	8	21	15	10	-8	-9	0	7	8	10	8	12	2	8	12	12	24	30	20	22	11	11.2
27	28	20	12	19	22	26	19	18	10	15	12	42	28	16	-12	-10	-13	-14	-10	-7	-13	-7	-8	0	8.0
28	0	-7	5	7	12	10	3	3	-7	-6	-8	-10	-8	-3	-2	-6	-7	0	-2	-6	-5	-3	0	-5	-1.9
29	-2	2	0	-9	4	2	12	2	-6	-1	-3	-3	-7	0	-7	0	-5	-4	-6	-5	-5	-3	-1	7	-1.6
30	4	10	0	3	-3	-1	6	1	-20	-19	-10	-7	-11	-8	-10	-13	-10	-16	-22	-17	-21	-13	-17	-18	-8.8
MEAN	2.3	2.9	0.5	2.0	3.9	3.0	2.7	0.0	-2.7	-0.7	-1.9	-0.7	0.5	0.3	-2.1	-0.6	-3.4	-6.0	-4.2	-4.9	-6.4	-5.7	-2.2	-0.4	-1.0

**** - INSUFFICIENT DATA AVAILABLE

PERCENTAGE OF DATA VALID 99.3

TOTAL MONTHLY SUM= -708.00 TOTAL MONTHLY RECORD HOURS = 715.00

TABLE: F-77

OWMC AIR POLLUTION SURVEY

MET. DATA TEMP. DIFF.(30m-10 m) UNITS 0.1 DEG. C

STATION LINCOLN COUNTY MONTH JUL 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	15	25	10	15	25	10	5	-5	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
2											DATA MISSING														
3											DATA MISSING														
4											DATA MISSING														
5											DATA MISSING														
6											DATA MISSING														
7											DATA MISSING														
8											DATA MISSING														
9											DATA MISSING														
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11											DATA MISSING														
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15											DATA MISSING														
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17											DATA MISSING														
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25											DATA MISSING														
26											DATA MISSING														
27											DATA MISSING														
28											DATA MISSING														
29											DATA MISSING														
30											DATA MISSING														
31											DATA MISSING														
MEAN	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	12.5

PERCENTAGE OF DATA VALID 1.1

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 100.00 TOTAL MONTHLY RECORD HOURS = 8.00

TABLE: F-78

OWMC AIR POLLUTION SURVEY

MET. DATA TEMP. DIFF.(30m-10 m)

UNITS 0.1 DEG. C

STATION LINCOLN COUNTY

MONTH AUG 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1																									
2											DATA MISSING														
3											DATA MISSING														
4											DATA MISSING														
5											DATA MISSING														
6											DATA MISSING														
7											DATA MISSING														
8											DATA MISSING														
9											DATA MISSING														
10											DATA MISSING														
11											DATA MISSING														
12	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0	0	0	0	20	30	****
13	30	40	30	20	30	50	50	40	40	0	0	0	0	0	0	10	-10	0	0	0	-10	0	10	0	13.8
14	10	0	10	10	20	10	10	10	10	20	10	0	0	0	0	10	0	0	0	0	0	0	0	10	5.8
15	0	10	10	10	10	10	10	0	10	0	10	10	0	10	0	10	0	0	-10	-10	10	10	10	0	5.0
16	0	10	0	0	0	0	0	10	10	10	10	0	10	0	0	0	0	0	0	0	0	0	0	0	2.5
17	0	0	10	0	10	0	0	0	0	-10	-20	-10	0	-10	0	10	0	10	0	10	10	20	20	30	3.3
18	0	0	0	0	0	0	10	0	0	0	-10	0	0	0	0	10	0	0	0	0	0	0	10	10	1.3
19	10	0	10	0	10	0	10	10	10	0	10	0	0	0	0	0	-10	0	0	-10	-10	0	20	20	3.3
20	10	10	20	20	20	20	20	10	10	10	0	10	0	10	0	0	0	0	0	0	-10	10	20	20	8.8
21	20	20	20	20	10	10	10	10	10	0	10	0	-10	-10	0	0	0	0	0	0	0	10	0	0	5.4
22	0	0	0	0	0	0	0	0	10	10	0	10	10	0	0	0	0	0	-10	-10	-20	-10	10	0	0.0
23	10	10	10	0	0	10	20	0	0	10	10	0	0	0	0	-10	0	-10	0	-10	0	-10	0	0	1.7
24	-20	-10	10	10	0	0	0	10	20	0	10	0	20	10	10	10	0	0	0	0	-10	-20	-10	0	1.7
25	0	0	20	0	10	20	20	20	20	20	10	10	0	0	-10	-20	-10	0	0	0	0	0	0	10	5.0
26	20	20	20	20	10	20	20	20	10	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	7.1
27	0	0	0	10	0	0	0	-10	0	10	0	0	0	0	0	0	0	0	-10	-10	0	0	0	0	-0.4
28	-5	0	0	0	0	0	0	0	10	0	10	20	0	10	10	10	10	0	0	0	0	-10	-10	-10	1.9
29	0	0	-10	10	10	10	10	10	20	20	20	****	0	0	0	0	0	0	0	0	-10	0	10	10	4.8
30	20	20	20	30	30	40	30	30	30	10	0	0	0	0	0	0	0	0	0	0	0	20	20	30	13.8
31	30	40	50	50	40	40	30	20	30	20	0	0	0	-10	0	0	-10	-10	-10	0	-20	10	10	0	12.9
MEAN	7.1	8.9	12.1	11.1	11.1	12.6	13.2	10.0	13.2	6.8	4.2	2.8	1.6	0.5	0.5	2.1	-1.6	-0.5	-2.0	-2.0	-3.5	2.0	7.0	8.0	5.2

PERCENTAGE OF DATA VALID 62.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 2385.00 TOTAL MONTHLY RECORD HOURS = 461.00

TABLE: F-79 OWMC AIR POLLUTION SURVEY

MET. DATA TEMP. DIFF.(30m-10 m) UNITS 0.1 DEG. C

STATION LINCOLN COUNTY MONTH SEP 1986

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	2	4	12	24	38	38	31	27	2	-9	-9	-8	-9	-9	-9	-10	-9	-8	-8	-4	6	16	24	28	6.7
2	18	18	23	21	29	37	38	36	0	-9	-8	-8	-9	-8	-8	-9	-8	-6	-5	1	9	7	7	6	7.2
3	4	5	7	6	11	15	12	9	-3	-8	-10	-9	-10	-8	-8	-6	-7	-7	-6	1	1	-3	-2	2	-0.6
4	6	0	-1	-2	-2	-3	-4	-5	-5	-5	0	0	-5	-6	-5	-4	-5	-6	-5	-3	-4	-4	-4	-3	-3.1
5	-3	-4	-2	4	11	5	0	1	-6	-7	-7	-6	-5	-6	-6	-5	-5	-5	-4	-2	3	4	2	1	-1.8
6	2	-1	-2	-3	-2	-2	-1	0	-6	-8	-8	-8	-7	-8	-10	-8	-7	-6	-4	-3	-1	-1	-4	-5	-4.3
7	-6	-6	-4	-4	1	1	7	3	-5	-7	-8	-8	-8	-8	-9	-8	-9	-8	-6	-3	2	2	3	7	-3.4
8	13	14	18	22	29	30	27	32	-1	-8	-8	-8	-7	-8	-8	-7	-7	-6	-5	-4	-1	0	0	2	4.5
9	3	5	5	5	5	4	10	13	-3	-7	-7	-6	-7	-7	-8	-8	-7	-6	-4	5	18	30	34	37	4.3
10	31	13	8	11	14	6	3	-2	-4	-5	-5	-5	-3	-5	-4	-5	-4	-5	-4	1	3	-2	-2	-3	1.3
11	-3	-3	-3	-10	0	0	0	0	0	0	0	2	-5	0	1	-3	10	0	4	-2	5	7	-5	0	-0.2
12	0	0	0	0	0	0	0	0	-5	0	-5	0	-5	-5	-5	-3	-5	-3	-1	-1	-2	1	8	2	-1.2
13	1	5	6	14	19	11	2	0	-6	-7	-7	-6	-4	-5	-6	-7	-7	-6	-5	-4	-3	-2	-2	-1	-0.8
14	0	6	4	11	11	5	2	7	-5	-8	-8	-8	-8	-9	-9	-9	-8	-6	-5	-3	0	5	1	-4	-1.6
15	0	0	0	0	-1	-3	-3	-4	-6	-7	-7	-7	-8	-7	-7	-7	-7	-7	-6	-5	-10	5	-5	2	-4.2
16	-6	3	3	6	5	5	15	15	-7	-7	-8	-8	-8	-8	-8	-8	-9	-7	-6	-1	5	9	3	5	-0.7
17	0	15	10	20	15	30	30	25	25	0	0	-5	-5	0	0	-5	-5	-15	-5	-10	-5	0	5	5	5.2
18	10	20	15	15	10	10	5	10	5	0	0	0	-5	-5	-5	-5	-5	-3	-3	-5	0	0	-1	-3	2.5
19	0	0	5	5	0	-5	-5	-5	-6	-6	-10	-11	-8	-12	-11	-10	-6	-4	-2	-2	3	-2	-2	-7	-4.2
20	-1	-5	0	0	-5	-5	0	0	0	-5	0	-5	-10	-5	0	-5	-5	-5	-5	-10	-5	-5	-5	-10	-4.0
21	-5	-10	-10	-5	-10	-5	-5	-5	-5	-5	-5	-11	-15	-7	-6	-7	-7	-7	-5	-3	-4	-4	-4	-4	-6.4
22	-3	0	0	-2	-4	-4	-3	-4	-5	-6	-6	-6	-6	-6	-6	-6	-5	-5	-4	-20	-37	-45	5	0	-7.4
23	0	5	-10	0	0	0	0	0	-5	-5	-10	-5	-5	-5	-5	-5	-6	-4	-4	-2	2	-1	0	0	-2.7
24	0	0	0	0	5	10	5	5	5	-10	-18	-14	-7	16	-8	-7	-7	-7	-3	0	4	10	5	20	0.2
25	34	38	36	37	30	14	15	14	3	-6	-6	-7	-6	-5	-5	-6	-16	-6	-5	0	8	-5	-5	-5	6.1
26	-1	-1	1	2	0	0	-10	0	-5	-9	-7	-6	-5	-4	-5	0	-6	-6	-5	-4	0	0	0	-5	-3.2
27	-5	-5	0	-7	-6	-5	-5	-6	-7	-7	-7	-8	-8	-7	2	****	****	****	****	****	****	****	****	****	-5.4
28	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	-6	-6	-6	-3	-1	****	****	****	****	****
29	-1	-2	-2	2	-10	-3	5	10	5	5	15	10	10	0	5	0	5	20	15	15	20	2	14	21	6.7
30	-3	-3	-4	-16	-4	-4	-4	-5	-5	-5	-5	-5	-6	-5	-6	-11	5	-14	-5	-5	-5	-5	-5	-20	-6.0
MEAN	3.0	3.8	4.0	5.4	6.5	6.3	5.8	5.9	-1.9	-5.6	-5.7	-5.7	-6.3	-5.2	-5.5	-6.2	-5.4	-5.3	-3.6	-2.6	0.4	0.7	2.3	2.4	-0.5

PERCENTAGE OF DATA VALID 96.1 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= -369.00 TOTAL MONTHLY RECORD HOURS = 692.00

TABLE: F-80 OWMC AIR POLLUTION SURVEY

MET. DATA TEMP. DIFF.(30m-10 m) UNITS 0.1 DEG. C

STATION LINCOLN COUNTY MONTH OCT 1986

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	-6	-6	-5	-5	-4	-4	-4	-2	-5	-6	-5	-6	-7	-6	-4	-6	-5	-5	-5	-4	-4	-4	-5	-5	-4.9
2	-5	-5	-5	-5	-6	****	****	****	-8	-7	-6	-8	-11	-8	-13	-11	-9	-7	-5	-2	1	3	9	15	-4.4
3	13	7	-3	-4	-3	-4	-5	-3	-4	-9	-20	-4	-7	-10	****	****	****	****	****	****	****	37	29	16	1.5
4	12	8	10	1	-2	-1	-2	-1	-2	0	-2	-5	-4	-4	-3	-3	-4	-2	-4	-4	-3	-2	-1	-4	-0.9
5	-2	-4	-5	-5	-4	-1	-3	-3	-3	-5	-4	-6	-7	-2	-7	-4	-7	-7	-2	-3	-3	0	-9	1	-4.0
6	-3	1	-1	2	0	-1	0	-3	-4	-3	-4	-3	-3	-5	-6	-2	-5	-7	-5	-7	-1	1	4	3	-2.2
7	6	5	15	15	10	0	0	1	-3	-6	-6	-4	-4	-4	-5	-3	-3	-1	-2	-4	0	-1	-2	-1	0.1
8	-2	-1	-1	-2	-4	-3	-2	-2	-2	-1	-4	-4	-4	-5	-4	-2	-4	-3	-3	1	6	-2	-5	1	-2.2
9	-1	3	-2	-22	-12	-12	-2	0	-4	-6	-7	-6	-2	-2	-4	-1	0	-2	-4	10	3	1	2	4	-2.8
10	4	1	3	-2	-2	2	0	-3	-3	-8	-8	-5	-5	-6	-7	-5	-5	-6	-10	4	-11	1	-6	-3	-3.3
11	-1	2	0	3	10	19	15	26	9	-6	-7	-6	-8	-7	-7	-7	-7	-6	1	5	13	9	2	-1	2.1
12	-3	-3	-5	-3	-1	0	-5	-4	-5	-6	-7	-6	-7	-6	-7	-6	-5	-4	-3	1	2	-4	-2	-3	-3.8
13	-6	-19	-29	-44	-19	-21	-21	-23	-20	-21	-22	-22	-14	-6	-7	-6	-10	-8	-10	-14	1	-1	-20	-13	-15.6
14	-4	-5	-10	-25	-18	-22	-6	-8	-10	-9	-8	-6	-7	-8	-7	-8	-6	-11	-18	-10	-8	-7	-6	-4	-9.6
15	-5	-5	-4	-4	-4	-5	-4	-4	-6	-8	-8	-7	-9	-8	-7	-7	-6	-5	-8	-6	-6	-6	-6	-4	-5.9
16	-4	-4	-1	-2	-5	-4	-3	-3	-5	-8	-8	-8	-9	-7	-8	-7	-6	-11	-11	-7	-4	-4	-5	-7	-5.9
17	-5	-4	-2	2	-3	-5	-6	-6	-6	-6	-7	-6	-7	-7	-8	-7	-6	-6	-3	-5	-4	3	4	3	-4.0
18	3	2	5	2	5	10	8	5	-1	-5	-7	-6	-7	-7	-7	-8	-7	-7	-2	-1	15	26	29	29	3.1
19	26	26	26	25	30	35	36	25	14	-3	-8	-6	-7	-7	-7	-7	-13	-17	-14	-14	-6	-10	-7	-7	4.6
20	0	9	9	0	2	11	13	10	6	-4	-6	-6	-6	-6	-9	-6	-6	-6	-6	-9	-2	-1	-1	2	-0.5
21	2	2	5	2	-3	-3	-4	-3	-4	-5	-6	-6	-6	-6	-7	-6	-6	-16	-10	-8	-4	-10	8	20	-3.1
22	29	24	24	25	20	24	19	11	24	1	-3	-5	-6	-6	-12	-6	-6	-4	-7	-14	-3	-3	-2	-1	5.1
23	-5	-10	-9	-10	-9	-10	-12	-17	-11	-1	-4	-17	-12	-5	-5	-5	-5	-5	-3	-5	-7	-11	-7	-4	-7.9
24	-3	-1	5	7	4	0	1	-3	-3	-7	-7	-7	-7	-8	-8	-10	-8	-10	-9	-3	1	-1	-3	1	-3.3
25	4	5	0	2	1	5	3	6	8	-3	-7	-7	-6	-6	-6	-7	-6	-7	-11	-5	-2	0	-2	4	-1.5
26	3	-1	-4	-4	-5	-6	-5	-5	-6	-6	-6	-7	-6	-6	-6	-9	-6	-6	-5	-7	-9	-5	****	****	-5.3
27	-5	-4	-3	-4	****	****	****	****	****	****	-7	-7	-6	-5	****	****	****	****	-4	****	-27	****	****	****	****
28	-4	-3	-5	-1	-3	-5	3	1	-5	-7	-7	-7	-7	-12	-7	-5	-7	-5	-3	-2	-1	-3	-3	-14	-4.7
29	-13	-14	-15	-17	-12	-13	-15	-9	-12	-10	-11	-11	-5	-5	-5	-7	-5	-4	-5	-5	-6	-6	-6	-6	-9.0
30	-4	-6	-6	-5	-3	-4	-6	-5	-8	-7	-8	-8	-4	-4	-5	-6	-9	-4	-2	8	11	17	20	29	-0.8
31	23	12	5	-1	7	5	10	3	-3	-7	-7	-7	-8	-7	-8	-7	-2	-1	6	-3	-3	-3	-3	-4	-0.1
MEAN	1.4	0.4	-0.3	-2.5	-1.1	-0.4	0.1	-0.7	-2.7	-6.0	-7.3	-7.1	-6.7	-6.2	-6.8	-6.0	-6.0	-6.3	-5.6	-3.9	-2.0	0.5	0.2	1.6	-3.1

PERCENTAGE OF DATA VALID 96.5 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= -2200.00 TOTAL MONTHLY RECORD HOURS = 718.00

TABLE: F-81 OWMC AIR POLLUTION SURVEY

MET. DATA TEMP. DIFF.(30m-10 m) UNITS 0.1 DEG. C

STATION LINCOLN COUNTY MONTH NOV 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	-2	-2	-1	-1	-1	-1	-2	-2	-2	-3	-3	-3	-2	-3	-3	-2	-2	-1	-4	-4	-4	-4	-3	-6	-2.5
2	-5	-5	-4	-5	-4	-5	-4	-4	-4	-4	-4	-5	-5	-6	-6	-4	-3	0	-1	0	-1	-1	1	10	-2.9
3	10	13	14	25	21	20	15	16	13	-3	-5	-5	-4	-4	-4	-3	-3	-3	-4	-3	-3	-1	-3	-3	4.0
4	-4	-2	-3	-3	-4	-4	-3	-2	-5	-5	-6	-6	-6	-6	-6	-6	-5	-2	-2	1	0	0	4	3	-3.0
5	2	1	1	1	2	1	0	1	-2	-5	-5	-5	-5	-5	-5	-5	-4	-3	-3	-3	-2	-2	-2	1	-1.9
6	1	3	3	-1	-1	-1	-2	-3	-5	-5	-6	-5	-5	-6	-6	-5	-3	2	1	7	9	21	30	36	2.5
7	36	24	16	17	19	18	7	14	8	-4	-6	-5	-4	-4	-4	-4	-4	-3	-3	-1	-1	0	4	6	5.3
8	11	8	12	7	5	2	-4	-8	-3	-4	-4	-4	-4	-3	-2	-2	-2	-2	-1	-1	0	0	-3	-1	-0.1
9	-1	-3	-2	-2	-3	-3	-3	-2	-2	-1	2	0	0	0	0	3	2	-3	-4	-5	-4	-4	-4	-4	-1.8
10	-5	-5	-4	-4	-4	-5	-5	-5	-6	-5	-6	-7	-7	-7	-7	-6	-3	-1	3	6	9	17	10	2	-1.9
11	4	9	17	8	-2	-3	-3	-3	-4	-3	-4	-4	-6	-5	-6	-5	-4	-2	-2	1	-2	-2	-3	-3	-1.1
12	-1	5	4	0	-1	-3	-4	-5	-6	-5	-5	-5	-5	-5	15	-5	-3	-3	-4	-4	-4	-3	-5	-5	-2.4
13	-5	-4	-5	-5	-5	-5	-5	-6	-6	-6	-6	-6	-8	-8	-8	-7	-6	-5	-5	-5	-5	-5	-4	-3	-5.5
14	-4	-4	-4	-4	-3	-5	-4	-5	-7	-7	-7	-7	-5	-5	-6	-5	-4	-4	-3	-3	-4	-3	-3	-4	-4.6
15	-3	-2	-2	-1	-2	2	0	-2	-4	-5	-5	-5	-5	-4	-4	-4	-3	-4	-3	-3	-3	-3	-4	-4	-3.0
16	-4	-3	-2	-2	-2	-1	-2	-3	-4	-5	-6	-5	-5	-5	-5	-5	-4	-1	0	0	2	2	0	1	-2.5
17	1	3	1	1	6	6	-1	-2	-4	-4	-3	-3	-4	-3	-4	-2	-2	1	2	1	5	5	8	7	0.6
18	8	8	9	6	8	3	-1	-2	-2	-4	-4	-5	-5	-5	-5	-5	-5	-5	-5	-4	-5	-4	-4	-5	-1.4
19	-5	-5	-4	-5	-5	-5	-5	-6	-6	-7	-6	-7	-6	-6	-7	-7	-6	-4	-3	-4	-5	-5	-5	-5	-5.4
20	-6	-6	-6	-7	-6	-6	-5	-6	-5	-6	-6	-6	-5	-5	-5	-4	-4	2	-4	-4	-5	-4	2	9	-4.1
21	-5	-5	-6	-5	-6	-6	-5	-4	-4	-5	-3	-4	-4	-5	-5	-5	-5	-3	-3	-2	2	2	5	5	-3.2
22	6	7	5	9	14	24	31	18	24	7	-3	-4	-4	-5	-5	-5	-2	3	4	1	0	5	6	12	6.2
23	10	9	7	8	20	3	-1	-2	-3	-4	-3	-3	-4	-3	-3	-2	-2	0	-3	-3	-4	-4	-23	-8	-0.8
24	-4	-4	-3	-4	-2	-3	-4	-2	-4	-4	-6	-6	-6	-5	-5	-4	-5	-4	-7	-3	-5	-4	-4	-4	-4.3
25	-2	-1	-1	-1	0	-1	2	1	-3	-5	-6	-6	-6	-6	-7	-6	-2	2	6	8	11	15	11	16	0.8
26	20	16	12	13	9	5	2	-2	-3	-12	-13	-13	-13	-13	-14	-14	-12	-7	-5	-5	-6	-5	-5	-4	-2.9
27	-3	-3	1	0	-1	-3	-2	-3	-6	-6	-5	-6	-5	-5	-5	-5	-3	-3	-3	-1	-3	-3	-4	-4	-3.4
28	-4	-3	-3	-5	-3	-2	-3	-5	-5	-6	-6	-5	-5	-5	-5	-5	-5	-4	-2	-3	-1	3	1	0	-3.4
29	-2	-2	-4	-3	-3	-4	-3	-3	-4	-6	-6	-6	-6	-5	-5	-5	-3	1	3	2	-2	-4	-4	-4	-3.3
30	-5	-4	-3	-5	-3	-4	-4	-4	-5	-6	-6	-7	-8	-8	-8	-7	-6	-6	-6	-5	-6	-5	-3	-1	-5.2
MEAN	1.3	1.4	1.5	1.1	1.4	0.5	-0.6	-1.4	-2.3	-4.6	-5.1	-5.3	-5.2	-5.2	-4.7	-4.7	-3.8	-2.1	-2.0	-1.3	-1.2	0.1	-0.1	1.3	-1.7

PERCENTAGE OF DATA VALID 100.0 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= -1225.00 TOTAL MONTHLY RECORD HOURS = 720.00

TABLE: F-82 OWMC AIR POLLUTION SURVEY

MET. DATA TEMP. DIFF.(30m-10 m) UNITS 0.1 DEG. C

STATION LINCOLN COUNTY MONTH DEC 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	-3	-4	-4	-5	-5	-5	-5	-5	-7	-6	-7	-6	-7	-7	-7	-6	-5	-5	-5	-5	-5	-5	-4	-3	-5.3
2	-4	-5	-5	-5	-3	-5	-5	-5	-4	-4	-4	-5	-5	-5	-5	-4	-4	-4	-4	-4	-4	-4	-8	-8	-4.7
3	-4	-4	-3	-3	-2	-2	0	-2	-3	-4	-4	-6	-6	-5	-4	-4	-3	-3	-4	-2	-1	-2	-3	-5	-3.3
4	0	0	-1	-3	-4	-3	-4	-5	-3	-3	-3	-2	-3	-3	-3	-6	-6	-5	-5	-5	-5	-6	-6	-6	-3.8
5	-6	-5	-6	-6	-6	-5	-6	-6	-6	-6	-6	-7	-6	-7	-5	-5	-5	-4	-1	-4	-3	-3	-2	-5	-5.0
6	-4	-5	-4	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-4	-2	-2	-1	-1	2	3	-3.7
7	24	33	29	20	6	-1	-4	-1	-4	-5	-5	-5	-5	-5	-4	-4	-4	-5	-5	-5	-4	-4	-4	-4	1.4
8	-4	-4	-4	-5	-6	-6	-6	-6	-7	-7	-8	-9	-8	-8	-8	-8	-7	-7	-6	-6	-6	-6	-6	-6	-6.4
9	-6	-7	-6	-6	-5	-5	-5	-5	-5	-5	-4	32	7	9	-9	-9	-6	-6	-12	-5	-5	-4	-4	-5	-3.2
10	-5	-5	-5	-5	-5	-5	-3	-2	-3	-3	-3	-2	-4	-5	-6	-4	-6	-5	-6	-6	-5	-6	-6	-6	-4.6
11	-5	-6	-6	-7	-7	-7	-7	-6	-7	-6	-6	-6	-6	-6	-7	-6	-4	-3	-3	-4	-4	-4	-5	-5	-5.5
12	-4	-4	-4	-4	-3	-3	-3	-5	-5	-6	-6	-6	-6	-6	-6	-7	-7	-6	-6	-7	-6	-6	-7	-7	-5.4
13	-6	-6	-6	-6	-6	-6	-5	-5	-6	-6	-7	-7	-7	-7	-7	-8	-7	-5	-1	3	0	-6	-5	-6	-5.3
14	-6	-5	-5	-6	-6	-6	-5	-5	-5	-5	-4	-4	-5	-5	-5	-2	-3	-4	-3	-2	-1	-4	-4	-4	-4.3
15	-4	-4	-5	-5	-4	-4	-5	-5	-5	-5	-5	-6	-5	-5	-6	-5	-4	-6	-6	-5	-5	-3	-3	-4	-4.8
16	-4	-5	-6	-5	-5	-5	-5	-4	-4	-5	-5	-6	-7	-6	-5	-5	-6	-6	-5	-4	-4	-4	-3	-3	-4.9
17	-3	-3	-4	-3	-1	-2	-3	-2	-3	-4	-5	-5	-6	-5	-5	-2	****	1	1	3	6	-1	2	3	-1.8
18	3	4	5	2	2	-3	3	2	-11	-8	-18	-9	-4	-6	-5	-5	-5	-5	-5	-5	-5	-4	-4	-4	-3.5
19	-3	-3	-4	-4	-4	-5	-5	-5	-5	1	-5	-5	-3	-5	-6	-6	-5	-5	-5	-5	-5	-4	-4	-4	-4.3
20	-4	-4	-5	-4	-2	-2	-2	-3	-4	-5	-6	-5	-6	-5	-6	-5	-3	-4	-4	-3	-3	-4	-4	-4	-4.0
21	-2	-3	-5	-5	-4	-3	-3	-2	-4	-5	-5	-4	-5	-7	-7	-6	-4	0	-1	-2	-2	-1	-2	-1	-3.5
22	0	-2	-3	-2	-2	-2	-4	-3	-4	-4	-4	-5	-5	-4	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-3.9
23	-5	-5	-3	-3	-5	-4	-5	-4	-5	-5	-5	-5	-5	-6	-6	-6	-6	-6	-6	-5	-5	-4	-2	-1	-4.7
24	-2	-3	-4	-3	-1	-3	-2	-3	-4	-5	-5	-5	-6	-5	-6	-6	-6	-7	-6	****	****	****	****	****	-4.3
25	****	****	****	****	****	****	****	****	****	****	****	-6	-6	-5	-5	-5	-4	-4	-5	-5	-6	-4	-5	-4	-4.9
26	-5	-5	-5	-5	-5	-5	-5	-5	-5	-6	-6	-6	-6	-6	-7	-6	-4	-4	-4	-4	-3	-5	-5	-4	-5.0
27	-4	-4	-4	-1	-2	0	-3	-2	0	-2	-3	-1	-4	-6	-6	-6	-5	-4	-4	-3	-4	-4	-4	-2	-3.3
28	-3	-3	-4	-3	-4	-4	-4	-4	-4	-4	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-4	-4.4
29	-5	-5	-5	-5	-6	-6	-5	-6	-5	-6	-6	-6	-7	-6	-5	-5	-5	-1	-1	1	2	5	3	0	-3.5
30	-2	0	3	6	-2	-1	2	-2	-4	-5	-5	-6	-6	-6	-5	-5	-6	-5	-5	-5	-5	-6	-5	-5	-3.3
31	-4	-5	-5	-5	-6	-2	-3	-5	-5	-5	-5	-5	-7	-6	-6	-5	-5	-5	-4	-4	-3	-4	-5	-4	-4.7
MEAN	-2.7	-2.6	-2.8	-3.0	-3.6	-3.8	-3.7	-3.9	-4.7	-4.8	-5.5	-4.1	-5.1	-5.1	-5.7	-5.4	-5.0	-4.4	-4.3	-3.7	-3.4	-3.8	-3.8	-3.8	-4.1

PERCENTAGE OF DATA VALID 97.7 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= -2995.00 TOTAL MONTHLY RECORD HOURS = 727.00

TABLE: F-83

OWMC AIR POLLUTION SURVEY

MET. DATA TEMP. DIFF.(30m-10 m)

UNITS 0.1 DEG. C

STATION LINCOLN COUNTY

MONTH JAN 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	-3	-1	-2	-1	-1	-2	-3	-2	-4	-5	-5	-5	-4	-5	-5	-4	-4	-3	-3	-2	-2	-3	-3	-3	-3.1
2	-1	1	-2	-1	-1	-1	-3	-3	-1	-4	-1	-2	-5	-3	-10	-11	-10	-12	-9	-14	-13	-13	-12	-10	-5.9
3	-7	-18	-7	-8	-9	-11	-15	-9	-11	-11	-10	-10	-12	-12	-9	-7	-6	-6	9	6	8	7	10	18	-5.0
4	20	27	28	29	21	10	13	21	20	12	16	7	-2	-6	-4	-2	-3	5	10	14	27	28	37	44	15.5
5	41	28	31	46	47	33	47	32	27	17	10	7	4	-3	-5	-6	-4	1	9	15	24	33	37	29	20.8
6	16	19	19	13	12	16	17	19	17	16	6	-3	-4	-3	-2	0	5	3	0	2	-1	-1	-1	-2	6.8
7	13	9	7	16	11	14	5	-6	-9	-9	-6	-12	-7	-7	5	1	12	5	2	3	2	1	1	3	2.3
8	-5	-3	-3	-4	-2	-2	-2	-6	-6	-7	-5	-6	-8	-7	-11	-10	-9	-6	-2	-3	-4	-3	-3	-3	-5.0
9	-4	-4	-4	-4	-4	-5	-5	-4	-5	-4	-5	-5	-6	-5	-6	-5	-5	-4	-2	1	-2	-3	-4	-4	-4.1
10	-5	-4	-5	-5	-4	-5	-5	-3	-3	-3	-2	-4	-3	-4	-4	-5	-6	-5	-4	-4	-4	-4	-4	-3	-4.1
11	-3	-4	-4	-4	-6	-6	-5	-5	-5	-5	-5	-5	-5	-5	-4	-4	-4	-4	-4	-5	-4	-3	-2	-3	-4.3
12	-3	-4	-4	-5	-5	-5	-5	-4	-5	-5	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-5	-3	-3	-4.2
13	-4	-1	-3	-3	-4	-4	-3	-3	-2	-4	-3	-4	-3	-3	-4	-4	-4	-2	-2	1	-1	-1	-4	-3	-2.8
14	1	0	0	-1	-1	-3	-2	-2	-2	-2	0	-1	-3	-3	-2	-3	-3	-2	-1	-1	****	****	****	****	-1.5
15	****	****	****	****	-4	-4	-3	-2	0	0	0	1	0	****	0	1	2	2	1	2	****	****	****	****	-0.3
16	****	****	****	****	-5	-5	-6	-6	-5	-6	-6	5	****	****	****	****	****	1	-1	****	****	****	1	-5	-3.2
17	-5	-5	-5	-5	-6	-4	-2	-2	-4	-5	-6	-5	-6	-7	-7	-7	-6	-5	-6	-5	-6	-6	-6	-5	-5.3
18	-5	-6	-5	-6	-3	-1	-2	-6	-18	-28	-21	-7	-6	-4	-3	-4	-3	-3	-4	-4	-2	1	9	5	-5.3
19	-4	7	9	3	8	3	10	-10	-14	-22	-40	-49	-6	-6	-9	-7	-6	-3	-4	-7	-6	-4	-9	-5	-7.1
20	-4	-5	0	-1	-3	-1	-1	3	3	-1	0	-3	-5	-5	-5	-5	-5	-4	-4	-4	-4	-5	****	****	-2.7
21											DATA MISSING														
22											DATA MISSING														
23	****	****	****	****	****	****	****	****	****	****	****	****	****	****	-2	-6	-5	-5	-6	-5	-5	-5	-4	****	
24	-6	-5	-5	-6	-5	-5	-6	-6	-5	-4	-1	0	0	-2	-4	-5	-5	-5	-5	-5	-5	-5	-5	-4	-4.4
25	-5	-5	-5	-5	-4	-4	-3	-2	-4	-6	-4	-5	-7	-7	-6	-6	-7	-2	3	7	15	19	20	20	-0.1
26	16	5	0	-4	-4	-5	-5	-5	-5	-5	-6	-7	-6	-6	-6	-6	-6	-5	-4	-1	9	12	23	19	-0.1
27	21	31	27	31	30	40	55	60	40	20	11	7	0	-5	-6	-6	-6	-5	-5	-4	-3	-3	-4	-4	13.4
28	-5	-3	-3	-3	-3	-2	-2	-5	-6	-6	-6	-6	-6	-6	-6	-5	-5	-5	-5	-5	-5	-5	-4	-4	-4.6
29	-5	-5	-2	-2	-2	-2	-3	-1	-1	-2	-4	-6	-5	-5	-5	-4	-3	-4	-1	-4	-5	-5	-5	-5	-3.6
30	-5	-5	-5	-6	-6	-4	-5	-5	-11	-17	-6	-37	-25	-23	-29	-19	-15	-5	-3	-4	-4	-5	-5	-5	-10.6
31	-6	-6	-6	-5	-6	-6	-6	-5	-5	-5	-5	-5	-5	-4	-5	-5	-5	-4	-3	-3	-1	-1	4	8	-3.8
MEAN	1.7	1.7	2.0	2.3	1.5	1.0	2.0	1.2	-0.9	-3.6	-3.9	-5.9	-5.1	-5.8	-5.8	-5.1	-4.3	-3.0	-1.6	-1.2	0.2	0.8	2.4	2.7	-1.2

PERCENTAGE OF DATA VALID 87.9

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= -762.00 TOTAL MONTHLY RECORD HOURS = 654.00

TABLE: F-84 OWMC AIR POLLUTION SURVEY

MET. DATA TEMP. DIFF.(30m-10 m) UNITS 0.1 DEG. C

STATION LINCOLN COUNTY MONTH FEB 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	17	21	25	28	19	6	-2	-4	-2	-5	-6	-4	-6	-5	-4	-4	-5	-4	-4	-4	-4	-4	-3	-4	1.8
2	-4	-4	-5	-16	-22	-28	-35	-18	-7	-5	-5	-5	-5	-5	-5	-5	-8	-21	-28	-26	-31	-34	-23	-31	-15.7
3	-39	-51	-35	-11	-4	-10	-7	-8	-11	-11	-12	-18	-16	-12	-8	-17	-12	-9	-12	-10	-12	-12	-7	-10	-14.8
4	-12	-13	-12	-10	-6	-8	-9	-3	-11	-16	-17	-29	-14	-8	-19	5	-3	-2	-7	-7	-4	-4	-9	-17	-9.8
5	-24	-21	-21	-20	-18	-19	-22	-22	-18	-30	-23	-22	-18	-10	-9	****	****	****	****	****	****	****	****	****	-19.8
6	****	****	****	****	3	3	0	-2	3	-5	-5	****	****	****	****	-10	-4	-4	-4	-4	-3	-2	-2	-7	-2.7
7	-3	-1	7	0	9	1	0	6	2	3	5	-1	1	-4	6	-4	5	3	-1	9	7	9	9	5	3.0
8	2	6	1	8	6	4	5	5	3	-5	2	7	3	-1	-9	-23	-7	-6	-5	-6	0	-6	-2	1	-0.7
9	1	-6	-6	-5	-5	-5	-5	0	6	6	5	11	11	16	16	-12	-20	-2	9	4	7	4	9	14	2.2
10	8	0	-1	-5	1	0	2	10	17	9	3	2	0	1	3	-5	0	-4	1	23	5	12	12	18	4.7
11	19	16	7	18	20	14	15	15	14	8	17	12	-3	0	-2	-2	-2	-1	2	-2	5	5	4	-5	7.3
12	3	2	4	-2	3	1	1	3	-1	-2	0	-2	-9	1	-2	3	1	5	0	3	3	0	-17	-12	-0.6
13	-12	-9	-4	-7	0	2	-2	-2	5	-2	3	3	12	8	8	8	2	3	7	8	8	10	9	17	3.1
14	21	6	2	3	5	6	6	1	3	3	-2	3	11	5	2	-2	3	5	1	7	2	-2	0	3	3.8
15	3	3	-5	-5	2	1	3	-1	7	5	6	5	8	9	8	12	5	5	7	17	18	18	3	0	5.6
16	3	5	5	1	0	0	3	1	2	0	13	8	3	3	6	3	5	0	8	8	8	7	8	8	4.5
17	1	1	8	11	8	11	13	13	18	13	10	8	3	7	5	1	0	-1	-4	3	5	48	53	48	11.8
18	8	13	19	18	8	9	17	8	10	18	6	6	6	3	3	8	6	3	3	9	4	4	3	4	8.2
19	18	8	18	19	37	33	13	43	36	38	18	8	8	5	6	3	3	6	0	8	3	3	8	7	14.5
20	16	22	18	26	14	33	42	49	33	23	8	3	2	7	-2	-2	-2	-1	-5	-2	-1	3	13	17	13.1
21	23	12	26	28	18	23	23	6	27	18	13	10	3	4	-8	-11	-14	-15	-2	-1	8	8	13	18	9.6
22	14	18	23	22	14	9	6	10	12	18	16	8	8	13	8	8	2	13	16	16	18	13	13	13	13.0
23	9	13	18	18	19	9	13	28	19	14	18	17	26	22	8	5	-2	-1	-3	-4	20	6	3	3	11.6
24	-2	8	3	0	-6	-7	8	0	-17	-17	-4	-2	-7	-4	-6	-7	-12	-17	-14	-17	-12	-9	-4	-7	-6.3
25	-7	-2	-4	8	8	6	11	23	18	7	6	-2	-2	0	-7	2	1	-2	8	13	3	18	19	6	5.5
26	13	5	8	8	6	23	13	20	16	8	8	-2	-2	-2	-5	-7	-2	-7	-17	-4	1	1	-1	-2	3.3
27	-2	-3	-2	3	-1	-2	-2	2	8	-7	5	2	-7	-7	-7	-10	-7	28	-17	-10	-5	0	-2	-2	-1.9
28	-1	-1	-7	-6	-1	-7	-7	-7	-9	-16	-7	-23	-8	-11	-9	-10	-8	-9	-10	-4	-3	-4	****	****	-7.6
MEAN	2.7	1.8	3.3	4.9	4.9	3.9	3.7	6.3	6.5	2.5	2.9	0.1	0.3	1.3	-0.9	-2.7	-2.8	-1.3	-2.6	1.0	1.9	3.4	4.2	3.3	2.0

PERCENTAGE OF DATA VALID 97.2 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 1333.00 TOTAL MONTHLY RECORD HOURS = 653.00

TABLE: F-85 OWMC AIR POLLUTION SURVEY

MET. DATA TEMP. DIFF.(30m-10 m) UNITS 0.1 DEG. C

STATION LINCOLN COUNTY MONTH MAR 1987

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	3	5	11	6	9	1	3	6	0	9	4	2	12	15	17	12	3	2	4	3	5	3	3	3	5.9
2	3	-3	0	-2	-1	0	3	3	6	5	1	2	2	4	-6	-8	0	3	-5	5	0	0	7	0	0.8
3	2	7	0	4	1	4	2	-10	-8	2	2	0	2	-1	-3	4	2	-2	1	3	-5	1	-6	-4	-0.1
4	-5	2	-1	4	0	0	6	2	-3	-5	-4	-2	2	4	5	0	0	0	2	-2	-3	-8	1	2	-0.1
5	-13	1	1	-3	4	4	10	10	17	30	8	2	0	2	-6	6	5	4	-6	4	4	-2	11	10	4.3
6	0	22	21	20	15	17	27	22	13	9	10	6	10	3	11	4	13	1	-1	2	-3	5	6	10	10.1
7	8	7	13	33	9	8	20	8	12	18	7	12	3	19	6	3	2	6	3	7	11	0	11	11	9.9
8	21	12	17	16	24	19	37	30	23	12	16	24	20	16	6	5	10	11	8	-8	12	17	20	15	16.0
9	14	9	5	7	3	2	7	1	-4	-14	-5	-1	5	5	-1	2	-4	12	6	6	5	4	5	7	3.2
10	2	8	3	2	2	4	4	7	1	3	5	2	2	1	-1	1	2	6	3	5	2	3	4	9	3.3
11	8	6	7	9	10	10	11	8	0	4	-8	2	37	12	2	4	4	3	8	17	22	3	2	4	7.7
12	9	4	8	14	17	10	8	6	4	-4	-2	0	-3	-6	-5	-1	2	3	-1	2	0	4	4	4	3.2
13	7	0	1	3	2	6	5	7	0	-3	5	0	-4	-6	-2	-1	1	0	-4	-3	2	8	10	12	1.9
14	7	12	9	14	14	9	11	10	4	4	-1	0	0	-4	-2	2	1	-1	3	2	2	-2	0	2	4.0
15	-7	-3	1	-3	0	1	21	1	11	10	-2	3	-1	-3	-8	****	****	-1	-12	-8	-3	0	2	5	0.2
16	6	10	4	7	10	3	4	8	25	17	6	-1	0	-1	2	12	11	6	-7	-10	-9	-6	-8	-6	3.5
17	-4	2	-3	-5	-7	-2	-1	-3	2	-4	2	-1	-6	-9	-3	-6	-5	****	29	34	32	30	31	29	5.7
18	31	30	21	32	30	27	32	24	14	21	23	30	19	7	9	3	1	5	8	14	19	29	25	21	19.8
19	20	21	24	7	4	2	0	0	-13	-8	-8	-9	-5	-10	-28	-6	-3	-4	-3	0	2	-1	-2	1	-0.8
20	2	2	2	-3	0	3	1	-2	0	-9	-6	-7	-8	-5	-8	-7	-6	-6	-3	-3	-7	-5	-2	4	-3.0
21	3	0	1	-1	2	1	-1	-1	-5	-8	-5	-10	-2	-6	-2	-7	-6	-4	-3	1	4	4	10	3	-1.3
22	-9	-6	-7	-6	-8	-9	-10	-7	-14	-14	-15	-16	-14	-13	-14	-12	-12	-15	-13	-1	-3	2	11	2	-8.5
23	-6	6	6	-2	16	18	19	18	8	-10	-14	-37	-12	-14	-12	-8	-10	-12	-8	-3	2	2	4	4	-1.9
24	-3	-10	-2	-1	20	4	10	12	2	-28	-8	-8	-16	-11	-14	-10	-12	-8	4	10	5	6	12	2	-1.8
25	14	12	2	7	0	-6	-10	-6	-5	-8	-10	-7	-8	-18	-11	-1	-8	-6	-6	-8	-13	-16	-5	-11	-5.3
26	-13	-10	-16	-10	-11	-14	-14	-12	-13	-12	-11	-18	-8	-11	-10	-10	-10	-11	-10	-12	-13	-11	-11	-13	-11.8
27	-13	-13	-13	-13	-13	-16	-13	-13	-15	-16	-20	-11	-6	-3	-3	-3	0	2	-8	-3	-5	0	-1	-2	-8.4
28	-3	-5	-6	0	-11	-8	-3	-3	-3	0	0	7	-1	0	-5	-6	-5	-8	-3	-8	5	0	5	-5	-2.8
29	-5	10	8	2	20	22	12	10	9	19	-1	5	12	12	12	2	10	2	-8	5	30	17	17	12	9.8
30	-3	-5	5	2	0	-3	-8	-3	-3	-2	-3	0	-8	4	-8	-9	-14	-13	-10	-11	-11	-7	-7	-6	-5.1
31	-1	-3	-2	-3	-2	-7	-6	-4	-3	-2	-2	-3	-1	-1	-1	-1	0	3	0	-1	-2	-2	-2	8	-1.6
MEAN	2.4	4.2	3.9	4.4	5.1	3.5	6.0	4.2	2.0	0.5	-1.2	-1.1	0.7	-0.6	-2.7	-1.2	-0.9	-0.7	-1.0	1.3	2.8	2.5	5.1	4.3	1.8

PERCENTAGE OF DATA VALID 99.6 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 1353.00 TOTAL MONTHLY RECORD HOURS = 741.00

TABLE: F-86 OWMC AIR POLLUTION SURVEY

MET. DATA TEMP. DIFF.(30m-10 m) UNITS 0.1 DEG. C

STATION LINCOLN COUNTY MONTH APR 1987

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	8	0	6	15	18	34	26	25	5	0	2	-4	-1	1	-7	-5	-3	4	3	1	7	9	3	3	6.3
2	3	5	3	-2	4	8	9	1	16	-7	-7	-7	-5	0	-4	-11	-9	-5	1	5	2	2	-2	-6	-0.3
3	-4	-1	-2	-1	-2	2	1	-2	-4	-11	-10	-10	-7	-11	-16	-7	-12	-9	-13	-8	-6	-7	-5	-4	-6.2
4	-10	-11	-5	-4	-3	0	-2	-1	5	5	3	8	11	8	11	14	10	3	1	5	-1	4	3	8	2.6
5	14	13	14	15	8	14	10	15	12	3	0	1	6	11	5	5	15	12	13	12	9	17	13	8	10.2
6	11	9	9	7	6	9	9	8	9	9	9	7	7	6	10	11	10	11	11	11	10	11	10	11	9.2
7	12	12	11	11	10	7	7	3	-2	-2	-3	-4	-3	-5	-5	-6	-6	-5	-3	-2	-1	0	0	0	1.1
8	1	1	2	3	3	4	5	3	1	-1	-2	-2	-1	-2	-4	-4	-4	0	0	1	4	7	11	17	1.8
9	22	19	21	22	14	12	19	17	9	-3	-5	-6	-6	-6	-5	-5	-5	-4	-2	2	7	8	8	9	5.9
10	7	5	5	4	4	10	14	9	1	-4	-6	-5	-3	-4	-5	-6	-6	-5	-4	-3	2	5	11	13	1.6
11	15	21	20	27	29	26	24	12	-1	-5	-5	-4	-4	-4	-6	-6	-5	-2	3	9	9	9	10	9	7.5
12	14	20	20	17	15	12	9	8	7	6	7	8	9	8	8	8	7	7	8	9	8	5	4	4	9.5
13	8	4	2	1	6	9	8	17	10	0	-6	-7	-7	-5	-9	13	13	10	20	21	13	6	10	6	6.0
14	3	16	11	30	25	29	23	20	5	-18	-14	-13	-4	4	12	5	20	12	9	10	13	12	6	8	9.3
15	11	15	16	5	10	5	8	7	21	12	5	4	1	-4	9	0	-2	-7	-1	6	3	-1	-3	0	5.0
16	-6	3	-2	1	-1	-8	-6	-8	-6	-1	-1	0	5	3	-3	-9	-11	-5	-1	0	-1	4	-2	0	-2.3
17	1	14	9	-2	3	0	3	9	7	7	4	5	3	4	-3	4	0	-5	6	1	2	1	9	6	3.7
18	24	17	18	40	25	26	20	9	0	3	5	3	1	-1	0	0	1	0	-4	1	0	4	19	26	9.9
19	24	25	24	27	28	21	21	14	17	17	7	0	-3	-1	-4	-3	-6	-5	-1	-7	-4	3	9	4	8.6
20	15	30	26	23	20	34	38	29	16	9	-1	-12	-10	-11	-3	-5	-3	1	1	9	6	11	24	24	11.3
21	23	41	47	51	49	25	31	35	24	-6	-4	-7	-3	-15	-2	-5	-5	-10	-2	3	16	5	6	-1	12.3
22	1	-2	-2	-3	-4	-4	-5	-4	-4	-6	-7	-7	-7	-8	-8	-9	-10	-7	-6	-3	-3	0	1	0	-4.5
23	1	1	1	2	3	4	10	12	12	1	-1	-2	6	14	14	15	15	15	15	14	14	15	15	16	8.8
24	13	14	14	15	15	15	8	0	-3	-4	-7	-12	-11	-10	-11	-10	-9	-9	-6	-2	0	1	5	3	0.4
25	5	6	5	3	6	5	5	0	-6	-9	-10	-9	-9	-9	-11	-10	-10	-8	-6	-5	-2	0	-1	-2	-3.0
26	-3	-2	2	2	-2	-1	-1	-3	-6	-7	-7	-7	-6	-7	-8	-8	-8	-7	-5	-4	2	4	3	0	-3.3
27	0	5	6	3	5	12	10	1	-6	-7	-7	-7	-6	-5	-5	-4	-3	-2	4	11	14	15	15	17	2.8
28	15	15	7	8	7	7	6	5	4	0	-2	-3	-2	-2	-4	-5	-2	-2	-3	-2	-1	1	3	9	2.5
29	9	10	15	19	20	16	7	6	-1	-4	-5	-5	-4	-4	-5	-1	1	-1	-3	-4	-3	-4	-4	-4	2.1
30	-5	-4	-5	-5	-5	-5	-5	-5	-4	-6	-7	-7	-7	-8	-9	-9	-8	-6	-6	-5	-3	1	6	5	-4.7
MEAN	7.7	10.0	9.9	11.1	10.5	10.9	10.4	8.1	4.6	-1.0	-2.5	-3.5	-2.0	-2.1	-2.3	-1.8	-1.2	-1.0	1.0	2.9	3.9	4.9	6.2	6.3	3.8

PERCENTAGE OF DATA VALID 100.0 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 2740.00 TOTAL MONTHLY RECORD HOURS = 720.00

TABLE: F-87 OWMC AIR POLLUTION SURVEY

MET. DATA TEMP. DIFF.(30m-10 m) UNITS 0.1 DEG. C

STATION LINCOLN COUNTY MONTH MAY 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	3	7	4	11	10	7	4	3	-5	-7	-7	-8	-6	-8	-8	-8	-7	-6	-6	-5	-3	1	3	2	-1.2
2	2	0	1	3	9	10	11	3	-4	-5	-8	-8	-10	-11	-13	-11	-10	-9	-8	-3	0	6	4	-4	-2.3
3	-3	-2	-2	-2	-2	-3	-4	-4	-5	-6	-6	-6	-7	-9	-8	-9	-9	-9	-8	-4	2	2	6	5	-3.9
4	6	5	7	3	4	3	1	-5	-8	-10	-10	-9	-9	-10	-11	-12	-11	-10	-8	-5	2	4	4	6	-3.0
5	6	9	9	26	9	6	16	0	-6	-6	-8	-8	-8	-9	-9	-8	-6	-5	-5	-3	4	6	6	6	0.9
6	5	20	24	29	31	21	15	0	-6	-7	-7	-7	-7	-6	-6	-7	-5	-5	-5	-3	-2	-1	1	2	3.1
7	9	4	-1	-1	1	9	5	-2	-5	-6	-7	-7	-7	-8	-8	-8	-6	-6	-6	-4	0	8	10	9	-1.1
8	7	6	14	30	46	44	20	0	-6	-8	-8	-8	-7	-8	-8	-7	-6	-6	-5	-4	1	0	1	3	3.8
9	3	1	2	1	0	-1	-1	-3	-4	-5	-6	-5	-4	-4	-5	-5	-4	-4	-3	-5	0	-1	-2	-6	-2.5
10	-7	-3	-4	-4	-3	-4	-5	-6	-10	-11	-11	-12	-14	-11	-13	-10	-11	-9	-7	-3	-2	9	9	3	-5.8
11	7	21	20	10	5	1	-2	-8	-9	-10	-5	-5	-4	-4	-4	-3	-4	-3	-3	-2	-2	1	-1	-1	-0.2
12	1	0	-3	-4	-3	-3	-3	-4	-7	-8	-9	-8	-8	-9	-8	-8	-8	-6	-6	-4	2	10	19	24	-2.2
13	11	13	11	12	18	18	21	6	-7	-7	-9	-8	-8	-9	-9	-8	-8	-7	-6	-5	-1	3	16	35	3.0
14	22	0	0	1	0	3	7	-2	-4	-4	-5	-5	-5	-5	-6	-5	-4	-4	-3	-6	****	34	35	31	3.3
15	33	33	21	8	13	12	8	6	-6	-3	-5	-9	-5	-6	-6	-7	-6	-6	-6	-4	-2	1	0	-2	2.6
16	1	9	18	16	12	19	19	0	-6	-7	-7	-8	-6	-7	-7	-7	-5	-5	-5	-4	-3	-3	0	0	0.6
17	0	1	2	5	8	12	12	-1	-5	-5	-6	-5	-6	-11	-6	-6	-7	-3	-5	-3	3	-1	4	4	-0.8
18	3	8	9	-1	12	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	1	0	****
19	1	0	0	0	-1	0	0	-1	-2	-2	-3	-5	-5	-5	-4	-4	-5	-2	0	2	5	9	11	8	-0.1
20	5	5	5	6	5	4	2	2	0	-1	-3	-5	-4	-5	-5	-5	-6	-5	-4	-2	1	-2	-1	0	-0.5
21	1	2	3	2	4	3	5	4	2	0	-2	-5	-4	-6	-7	-6	-6	-5	-4	-3	5	23	5	0	0.5
22	1	1	4	5	6	7	7	5	2	7	0	-3	-3	17	20	8	2	-1	-1	0	2	24	40	45	8.1
23	43	37	33	39	33	36	33	19	7	0	-2	-5	-4	-3	-4	-5	-6	-4	-3	-3	-3	-1	-2	-3	9.7
24	-3	-2	-1	4	10	13	16	5	-3	-4	-4	-4	-4	-5	-5	-5	-4	-3	-4	-3	-2	-2	0	7	-0.1
25	20	43	52	54	43	34	31	10	2	1	-2	-1	-2	-3	-5	-5	-6	-5	-4	-2	3	14	23	22	13.2
26	24	27	35	35	32	30	36	43	36	31	22	19	16	4	0	-4	-3	-3	-3	1	10	7	17	27	18.3
27	37	51	50	49	49	52	49	41	45	24	16	6	0	-2	-4	-4	-4	-4	-3	-2	0	8	30	41	21.9
28	38	32	23	23	21	26	24	15	5	-1	-3	-5	-5	-4	-5	-2	-2	-3	-2	-1	0	0	2	3	7.4
29	5	1	3	6	13	23	27	12	0	-5	-6	-6	-5	-6	****	****	****	****	****	****	****	****	****	****	4.4
30											DATA MISSING														
31											DATA MISSING														
MEAN	9.7	11.3	11.7	12.6	13.3	13.6	12.6	4.9	-0.3	-2.3	-4.0	-5.0	-5.0	-5.5	-5.7	-6.0	-5.8	-5.1	-4.6	-3.0	0.8	5.9	8.6	9.5	2.7

PERCENTAGE OF DATA VALID 89.8 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 1828.00 TOTAL MONTHLY RECORD HOURS = 668.00

TABLE F-88

Summary of Air Temperature Levels at OWMC Preferred Site (°C)
June 1986 to May 1987

Month	Mean		Maximum Hourly Mean		Minimum Hourly Mean	
	10 m	30 m	10 m	30 m	10 m	30 m
1986						
June	18.2	18.0	28	28	4	5
July	NA	21.1	NA	30	NA	12
August	NA	20.1	28	29	4	5
September	16.4	16.3	27	28	2	3
October	11.0	10.6	21	23	0	2
November	2.9	2.8	18	18	-10	-11
December	0.1	-0.3	5	5	-11	-12
1987						
January	-3.2	-3.4	7	7	-18	-18
February	-3.6	-3.4	5	6	-17	-17
March	1.8	2.0	18	18	-13	-13
April	8.6	9.0	26	25	-7	-5
May	14.3	15.2	31	31	1	1
Summer 1986	NA	19.8	NA	30	4	5
Fall 1986	10.1	9.8	27	28	-10	-11
Winter 86-87	-2.2	-2.3	7	7	-18	-18
Spring 1987	8.0	8.7	31	31	-13	-13
Annual	7.4	9.2	31	31	-21*	-21*

Notes:
NA - not available due to insufficient data available
*March 1986 value

TABLE F-89

Summary of Air Temperature Difference
(30 m - 10 m) at OWMC Preferred Site (°C)
June 1986 to May 1987

Month	Mean	Maximum Hourly Mean	Minimum Hourly Mean
1986			
June	-.10	4.2	-5.0
July	NA	NA	NA
August	-.52	5.0	-2.0
September	-.05	3.8	-4.5
October	-.31	3.7	-4.4
November	-.17	3.6	-2.3
December	-.41	3.3	-1.8
1987			
January	-.12	6.0	-4.9
February	-.20	5.3	-5.1
March	.18	3.7	-3.7
April	.38	5.1	-1.8
May	.27	5.4	-1.4
Summer	.15	5.0	-5.0
Fall	-.18	3.8	-4.5
Winter	-.12	6.0	-5.1
Spring	.28	5.4	-3.7
Annual	.19	6.0	-5.1

Note:

NA - not available due to insufficient data available

TABLE: F-90 OWMC AIR POLLUTION SURVEY

MET. DATA SOLAR RADIATION UNITS WATTS/m**2

STATION LINCOLN COUNTY MONTH JUN 1986

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	0	0	13	79	201	381	548	700	801	965	****	****	****	****	****	****	****	****	****	****	****	283.7
2	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	813	667	489	297	132	26	0	0	0	****
3	0	0	0	0	0	7	92	258	462	555	773	912	938	938	905	832	674	482	284	106	13	0	0	0	343.0
4	0	0	0	0	0	7	99	264	456	628	769	888	931	938	896	813	674	482	277	244	20	0	0	0	349.4
5	0	0	0	0	0	3	5	13	59	46	59	86	106	73	106	79	53	59	53	33	8	0	0	0	35.0
6	0	0	0	0	0	1	7	17	46	106	125	238	535	561	786	661	52	396	284	132	40	0	0	0	166.1
7	0	0	0	0	0	0	26	66	106	238	324	231	304	284	324	601	324	396	205	53	13	0	0	0	145.6
8	0	0	0	0	0	0	26	86	324	509	535	694	694	945	912	753	634	548	350	178	53	0	0	0	301.7
9	0	0	0	0	0	53	165	390	522	654	786	859	839	852	628	753	568	377	211	73	7	0	0	0	322.4
10	0	0	0	0	0	53	152	416	548	713	839	680	733	601	542	350	317	106	92	26	0	0	0	0	257.0
11	0	0	0	0	0	7	20	86	79	106	277	410	733	588	595	350	92	13	13	13	7	0	0	0	141.2
12	0	0	0	0	0	0	26	92	132	66	92	311	449	337	383	595	106	132	145	132	20	0	0	0	125.8
13	0	0	0	0	0	7	13	112	139	172	727	766	694	489	667	561	370	205	284	125	26	0	0	0	223.2
14	0	0	0	0	0	26	106	264	449	595	773	872	925	931	879	793	575	106	26	7	0	0	0	0	305.3
15	0	0	0	0	0	7	20	698	106	145	271	311	297	139	165	119	238	317	251	112	26	0	0	0	134.3
16	0	0	0	0	0	7	66	192	330	529	687	806	806	707	667	350	73	46	231	106	20	0	0	0	234.3
17	0	0	0	0	0	20	79	284	456	647	786	892	938	951	912	832	661	515	178	139	26	0	0	0	346.5
18	0	0	0	0	0	13	106	271	469	641	780	885	958	793	661	601	568	515	311	132	26	0	0	0	322.1
19	0	0	0	0	0	7	66	165	277	304	238	244	264	211	92	73	86	66	53	33	13	0	0	0	91.3
20	0	0	0	0	0	13	53	205	277	469	542	667	793	846	872	793	65	495	284	106	26	0	0	0	271.1
21	0	0	0	0	0	13	86	211	436	489	786	912	912	918	905	819	680	502	271	112	26	0	0	0	336.6
22	0	0	0	0	0	26	33	33	238	363	667	661	819	839	760	548	575	396	185	53	0	0	0	0	258.2
23	0	0	0	0	0	13	99	251	443	628	780	879	931	938	912	885	720	509	304	125	20	0	0	0	351.5
24	0	0	0	0	0	7	53	238	317	225	271	343	277	343	383	343	330	291	291	119	20	0	0	0	160.5
25	0	0	0	0	0	20	112	271	462	628	773	918	1096	1030	1024	727	529	396	277	106	33	0	0	0	350.1
26	0	0	0	0	0	7	59	251	456	634	661	819	661	1017	515	489	614	469	238	66	26	0	0	0	290.9
27	0	0	0	0	0	7	59	178	238	462	297	92	130	173	78	260	479	224	311	129	45	0	0	0	131.8
28	0	0	0	0	0	0	19	82	288	491	716	824	869	897	873	788	634	403	218	103	20	0	0	0	301.0
29	0	0	0	0	0	0	21	179	389	573	727	829	897	836	705	318	193	285	121	22	0	0	0	0	254.0
30	0	0	0	0	0	0	36	181	325	365	415	503	561	795	809	635	517	491	265	107	20	0	0	0	251.0
MEAN	0	0	0	0	0	12	62	205	318	432	558	632	692	678	641	570	416	335	218	97	20	0	0	0	244.0

PERCENTAGE OF DATA VALID 96.4 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 169331.00 TOTAL MONTHLY RECORD HOURS = 694.00

TABLE: F-91

OWMC AIR POLLUTION SURVEY

MET. DATA SOLAR RADIATION

UNITS WATTS/m**2

STATION LINCOLN COUNTY

MONTH JUL 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	0	0	0	46	174	322	463	693	828	845	751	513	248	87	66	30	24	0	0	0	0	212.1
2	0	0	0	0	0	0	5	10	53	168	318	798	880	879	853	586	425	134	76	16	25	0	0	0	217.8
3	0	0	0	0	0	0	26	188	394	576	656	778	880	914	891	808	673	506	317	133	10	0	0	0	322.9
4	0	0	0	0	0	0	18	199	389	557	700	820	875	833	397	57	132	326	285	89	10	0	0	0	237.0
5	0	0	0	0	0	0	34	107	183	286	415	565	579	685	812	714	590	439	264	123	18	0	0	0	242.3
6	0	0	0	0	0	0	39	183	364	541	688	812	854	876	844	771	624	472	287	110	13	0	0	0	311.6
7	0	0	0	0	0	0	34	137	195	393	517	696	810	637	474	194	309	258	251	112	20	0	0	0	209.9
8	0	0	0	0	0	0	30	203	174	313	414	206	321	174	219	177	491	283	256	84	26	0	0	0	140.5
9	0	0	0	0	0	0	2	32	201	180	129	200	551	736	567	765	665	487	301	136	20	0	0	0	207.3
10	0	0	0	0	0	0	22	181	293	520	710	712	898	906	798	595	549	205	136	71	41	0	0	0	276.5
11	0	0	0	0	0	0	71	190	401	292	185	140	165	155	145	286	189	154	35	0	0	0	0	0	100.3
12	0	0	0	0	0	0	0	8	26	73	162	134	135	128	131	189	184	88	76	34	0	0	0	0	57.0
13	0	0	0	0	0	0	49	98	153	230	600	770	817	861	421	464	663	503	318	121	7	0	0	0	253.1
14	0	0	0	0	0	0	16	53	89	446	496	528	426	590	797	459	434	379	329	120	15	0	0	0	215.7
15	0	0	0	0	0	0	20	169	362	540	686	812	888	875	790	796	618	535	316	123	9	0	0	0	314.1
16	0	0	0	0	0	0	8	61	191	30	48	87	186	242	397	502	236	363	281	88	19	0	0	0	114.1
17	0	0	0	0	0	0	13	80	133	123	10	122	334	605	843	591	490	469	237	92	9	0	0	0	173.0
18	0	0	0	0	0	0	5	57	247	441	420	600	499	661	728	742	629	400	217	0	0	0	0	0	235.3
19	0	0	0	0	0	0	1	48	115	224	461	298	155	237	434	643	535	452	204	26	0	0	0	0	159.7
20	0	0	0	0	0	0	8	52	104	220	152	325	444	596	520	402	579	454	288	113	15	0	0	0	178.0
21	0	0	0	0	0	0	13	79	202	425	220	240	797	718	604	738	627	484	286	111	11	0	0	0	231.5
22	0	0	0	0	0	0	18	139	348	471	622	638	814	704	672	340	410	396	257	117	11	0	0	0	248.2
23	0	0	0	0	0	0	18	156	340	525	671	695	866	859	820	767	662	492	294	105	9	0	0	0	303.3
24	0	0	0	0	0	0	18	122	256	443	637	791	885	903	867	795	661	497	296	118	9	0	0	0	304.1
25	0	0	0	0	0	0	17	140	305	450	603	741	671	436	590	351	127	71	81	69	0	0	0	0	193.8
26	0	0	0	0	0	0	0	6	48	154	442	426	281	112	148	311	152	135	95	29	0	0	0	0	97.5
27	0	0	0	0	0	0	0	41	169	301	428	587	612	574	893	757	644	475	276	101	6	0	0	0	244.3
28	0	0	0	0	0	0	16	132	301	497	591	697	679	414	699	509	629	463	150	24	7	0	0	0	242.0
29	0	0	0	0	0	0	7	39	192	224	461	494	395	548	456	461	379	384	160	81	0	0	0	0	178.4
30	0	0	0	0	0	0	0	53	189	327	209	413	477	341	328	682	650	485	220	38	2	0	0	0	183.9
31	0	0	0	0	0	0	1	76	269	331	487	494	311	282	336	422	576	441	124	36	0	0	0	0	174.4
MEAN	0	0	0	0	0	0	18	104	226	347	446	531	591	588	580	520	472	364	218	79	10	0	0	0	212.2

PERCENTAGE OF DATA VALID 100.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 157905.00 TOTAL MONTHLY RECORD HOURS = 744.00

TABLE: F-92

OWMC AIR POLLUTION SURVEY

MET. DATA SOLAR RADIATION

UNITS WATTS/m**2

STATION LINCOLN COUNTY

MONTH AUG 1986

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	0	0	0	2	29	56	29	122	122	722	655	655	389	362	322	149	3	0	0	0	0	150.7
2	0	0	0	0	0	0	29	109	282	415	282	522	628	628	655	588	522	322	96	16	0	0	0	0	212.3
3	0	0	0	0	0	0	29	162	335	522	722	828	588	628	455	522	548	362	162	29	0	0	0	0	245.5
4	0	0	0	0	0	0	56	229	455	588	522	588	588	588	588	588	522	322	149	29	0	0	0	0	242.2
5	0	0	0	0	0	0	56	189	375	535	695	788	815	815	788	682	508	255	96	16	0	0	0	0	275.5
6	0	0	0	0	0	0	29	122	189	375	375	455	655	548	548	522	442	289	96	16	0	0	0	0	194.2
7	0	0	****	****	****	****	****	****	****	****	****	202	136	522	162	282	282	109	42	2	0	0	0	0	115.9
8	0	0	0	0	0	0	0	2	69	29	335	588	482	514	507	689	547	323	125	26	0	0	0	0	176.5
9	0	0	0	0	0	0	0	109	242	255	495	389	522	455	455	455	455	292	109	56	2	0	0	0	178.8
10	0	0	0	0	0	0	0	2	82	96	255	455	522	495	375	176	109	56	29	29	2	0	0	0	111.8
11	0	0	0	0	0	0	2	109	322	522	615	642	655	823	702	663	595	449	212	81	0	0	0	0	266.3
12	0	0	0	0	0	0	9	81	317	498	653	786	599	374	245	361	387	179	166	75	0	0	0	0	197.1
13	0	0	0	0	0	0	5	105	290	475	628	698	664	604	629	674	575	404	209	56	2	0	0	0	250.8
14	0	0	0	0	0	0	1	82	215	375	455	455	153	165	544	575	275	133	83	39	0	0	0	0	147.9
15	0	0	0	0	0	0	4	62	130	219	382	639	676	735	542	640	483	253	77	11	0	0	0	0	202.2
16	0	0	0	0	0	0	0	86	132	322	405	602	605	596	762	677	549	394	188	51	0	0	0	0	223.7
17	0	0	0	0	0	0	0	77	181	404	579	686	797	****	496	618	505	332	197	59	0	0	0	0	214.4
18	0	0	0	0	0	0	0	97	266	450	612	748	830	842	822	721	582	394	186	35	0	0	0	0	274.4
19	0	0	0	0	0	0	0	117	287	279	693	756	849	855	808	733	588	492	209	58	0	0	0	0	280.2
20	0	0	0	0	0	0	0	56	242	375	455	655	775	788	722	655	535	389	149	29	0	0	0	0	242.7
21	0	0	0	0	0	0	0	29	162	389	455	615	429	189	136	255	362	295	249	2	0	0	0	0	148.6
22	0	0	0	0	0	0	0	82	282	389	548	588	655	855	655	655	588	375	176	16	0	0	0	0	244.3
23	0	0	0	0	0	0	0	29	82	149	136	389	255	149	56	149	282	189	162	29	0	0	0	0	85.7
24	0	0	0	0	0	0	0	82	255	402	682	815	895	855	815	722	588	389	189	29	0	0	0	0	279.9
25	0	0	0	0	0	0	0	109	189	322	455	628	735	775	775	628	402	162	56	2	0	0	0	0	218.3
26	0	0	0	0	0	0	0	56	136	389	495	668	668	562	535	255	162	16	0	0	0	0	0	0	164.3
27	0	0	0	0	0	0	0	16	56	229	322	495	389	229	389	522	442	415	96	16	0	0	0	0	150.7
28	0	0	0	0	0	0	0	56	255	455	602	788	855	815	788	347	244	312	136	56	0	0	0	0	237.9
29	0	0	0	0	0	0	0	78	272	385	588	693	837	716	584	490	201	329	138	27	0	0	0	0	222.4
30	0	0	0	0	0	0	0	70	258	445	537	323	679	527	794	603	515	330	145	26	0	0	0	0	218.8
31	0	0	0	0	0	0	0	66	258	445	537	333	679	527	794	603	515	339	145	26	0	0	0	0	219.5
MEAN	0	0	0	0	0	0	7	83	222	359	488	579	624	594	574	530	441	298	136	31	0	0	0	0	207.3

PERCENTAGE OF DATA VALID 98.7

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 152182.00 TOTAL MONTHLY RECORD HOURS = 734.00

TABLE: F-93 OWMC AIR POLLUTION SURVEY

MET. DATA SOLAR RADIATION UNITS WATTS/m**2

STATION LINCOLN COUNTY MONTH SEP 1986

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	0	0	0	6	78	245	427	582	718	760	707	721	674	549	359	218	46	1	0	0	0	253.8
2	0	0	0	0	0	0	4	69	225	415	570	585	767	562	655	624	478	287	125	22	1	0	0	0	224.5
3	0	0	0	0	0	0	4	67	218	395	550	667	796	662	589	285	418	311	128	17	0	0	0	0	212.8
4	0	0	0	0	0	0	2	38	119	145	323	323	288	168	204	143	194	237	105	10	0	0	0	0	95.8
5	0	0	0	0	0	0	3	70	243	442	587	709	788	757	483	394	350	271	141	21	0	0	0	0	219.1
6	0	0	0	0	0	0	3	75	245	433	595	740	709	680	813	456	413	129	77	17	0	0	0	0	224.4
7	0	0	0	0	0	0	4	50	136	338	478	650	738	536	672	506	503	317	126	18	0	0	0	0	211.3
8	0	0	0	0	0	0	4	74	241	435	590	714	788	766	738	644	494	299	115	14	0	0	0	0	246.5
9	0	0	0	0	0	0	3	65	229	413	570	677	740	719	722	613	486	296	118	11	0	0	0	0	235.9
10	0	0	0	0	0	0	1	14	86	231	140	151	40	36	107	199	85	94	43	2	0	0	0	0	51.2
11	0	0	0	0	0	0	1	3	26	24	65	65	61	161	71	86	91	38	15	3	0	0	0	0	29.6
12	0	0	0	0	0	0	0	0	16	43	176	123	418	283	226	134	97	98	52	6	0	0	0	0	69.7
13	0	0	0	0	0	0	2	61	210	395	547	332	82	153	347	369	362	283	102	10	0	0	0	0	135.6
14	0	0	0	0	0	0	2	60	211	416	570	706	730	761	712	610	442	196	71	7	0	0	0	0	228.9
15	0	0	0	0	0	0	0	12	33	55	74	108	75	33	30	117	92	54	22	1	0	0	0	0	29.4
16	0	0	0	0	0	0	1	57	206	319	495	562	629	522	719	609	417	195	63	4	0	0	0	0	199.9
17	0	0	0	0	0	0	0	40	161	362	470	512	550	711	630	609	450	322	148	4	0	0	0	0	207.0
18	0	0	0	0	0	0	0	5	94	148	154	235	242	362	101	114	74	40	34	2	0	0	0	0	66.9
19	0	0	0	0	0	0	0	28	60	188	287	223	311	289	334	259	109	46	16	1	0	0	0	0	89.6
20	0	0	0	0	0	0	0	5	33	50	111	133	146	159	133	108	57	36	10	1	0	0	0	0	40.9
21	0	0	0	0	0	0	0	13	74	151	224	347	342	204	387	446	320	188	44	3	0	0	0	0	114.3
22	0	0	0	0	0	0	0	7	57	107	121	148	307	107	107	121	121	40	24	1	0	0	0	0	52.8
23	0	0	0	0	0	0	0	5	27	81	154	248	537	295	175	282	322	88	37	2	0	0	0	0	93.9
24	0	0	0	0	0	0	0	29	115	215	306	560	510	677	634	532	332	207	49	2	0	0	0	0	173.7
25	0	0	0	0	0	0	0	12	81	136	243	155	151	154	140	141	124	119	44	1	0	0	0	0	62.5
26	0	0	0	0	0	0	0	15	107	306	329	523	313	67	13	130	136	64	18	1	0	0	0	0	84.3
27	0	0	0	0	0	0	0	7	33	82	223	271	386	184	143	98	71	65	21	1	0	0	0	0	66.0
28	0	0	0	0	0	0	0	14	61	100	157	172	182	166	184	228	187	128	26	1	0	0	0	0	66.9
29	0	0	0	0	0	0	0	3	4	215	309	188	188	127	134	416	295	54	****	0	0	0	0	0	84.0
30	0	0	0	0	0	0	0	11	72	85	118	134	324	201	182	87	99	29	2	0	0	0	0	0	56.0
MEAN	0	0	0	0	0	0	1	33	122	238	337	389	430	374	370	335	272	163	69	7	0	0	0	0	131.0

PERCENTAGE OF DATA VALID 99.9 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 94174.00 TOTAL MONTHLY RECORD HOURS = 719.00

TABLE: F-94 OWMC AIR POLLUTION SURVEY

MET. DATA SOLAR RADIATION UNITS WATTS/m**2

STATION LINCOLN COUNTY MONTH OCT 1986

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	0	0	0	0	25	153	336	432	301	268	216	208	149	93	48	13	2	0	0	0	0	93.5
2	0	0	0	0	0	0	0	6	15	66	128	129	196	244	230	402	349	155	0	0	0	0	0	0	80.0
3	0	0	0	0	0	0	0	4	22	28	50	84	93	58	30	22	58	18	3	0	0	0	0	0	19.6
4	0	0	0	0	0	0	0	8	59	68	91	73	87	64	61	61	45	29	4	0	0	0	0	0	27.1
5	0	0	0	0	0	0	0	11	55	115	182	205	471	481	478	322	326	132	132	25	0	0	0	0	122.3
6	0	0	0	0	0	0	0	7	69	329	315	578	494	455	529	316	324	152	21	0	0	0	0	0	149.5
7	0	0	0	0	0	0	0	21	136	320	479	593	649	639	584	393	305	139	25	2	0	0	0	0	178.5
8	0	0	0	0	0	0	0	9	95	108	117	158	167	226	377	191	54	51	6	0	0	0	0	0	65.0
9	0	0	0	0	0	0	0	7	111	288	463	560	610	550	372	329	121	49	15	0	0	0	0	0	144.8
10	0	0	0	0	0	0	0	12	88	239	414	278	585	544	564	449	283	123	19	0	0	0	0	0	149.9
11	0	0	0	0	0	0	0	14	119	286	435	542	444	276	400	392	246	91	16	0	0	0	0	0	135.9
12	0	0	0	0	0	0	0	6	75	225	270	519	259	225	167	164	106	57	4	0	0	0	0	0	86.5
13	0	0	0	0	0	0	0	2	20	61	87	100	188	262	367	256	197	56	4	0	0	0	0	0	66.7
14	0	0	0	0	0	0	0	1	23	234	116	68	64	65	151	77	52	66	7	0	0	0	0	0	38.5
15	0	0	0	0	0	0	0	12	108	278	436	563	355	410	177	203	159	81	6	0	0	0	0	0	116.2
16	0	0	0	0	0	0	0	9	144	192	163	156	318	264	303	114	71	36	2	0	0	0	0	0	73.8
17	0	0	0	0	0	0	0	4	20	50	68	26	61	91	176	135	39	19	2	0	0	0	0	0	28.8
18	0	0	0	0	0	0	0	6	41	166	224	331	352	577	540	404	240	97	10	0	0	0	0	0	124.5
19	0	0	0	0	0	0	0	0	94	249	403	516	573	570	515	400	237	90	8	0	0	0	0	0	152.3
20	0	0	0	0	0	0	0	6	81	229	384	493	538	541	480	379	227	81	7	0	0	0	0	0	143.6
21	0	0	0	0	0	0	0	6	52	186	290	227	104	160	406	353	174	53	7	0	0	0	0	0	84.1
22	0	0	0	0	0	0	0	3	39	99	95	187	210	326	209	305	155	46	3	0	0	0	0	0	69.9
23	0	0	0	0	0	0	0	0	5	80	73	140	166	90	65	114	58	20	2	0	0	0	0	0	33.9
24	0	0	0	0	0	0	0	5	75	230	365	497	537	542	466	345	188	60	4	0	0	0	0	0	138.1
25	0	0	0	0	0	0	0	4	55	125	201	278	268	217	205	166	62	17	2	0	0	0	0	0	66.7
26	0	0	0	0	0	0	0	2	27	56	118	191	175	198	123	96	31	12	1	0	0	0	0	0	42.9
27	0	0	0	0	0	0	0	22	65	88	118	99	87	58	66	52	20	3	0	0	0	0	0	0	28.3
28	0	0	0	0	0	0	0	52	86	148	189	473	437	479	259	180	60	4	0	0	0	0	0	0	98.6
29	0	0	0	0	0	0	0	60	180	300	306	306	95	109	67	13	27	2	0	0	0	0	0	0	61.0
30	0	0	0	0	0	0	0	58	112	237	290	275	359	414	283	132	46	4	0	0	0	0	0	0	92.1
31	0	0	0	0	0	0	0	55	194	351	460	514	511	455	340	190	60	4	0	0	0	0	0	0	130.6
MEAN	0	0	0	0	0	0	0	14	78	186	250	305	314	316	297	229	142	58	10	1	0	0	0	0	91.7

PERCENTAGE OF DATA VALID 100.0 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 68233.00 TOTAL MONTHLY RECORD HOURS = 744.00

TABLE: F-95

OWMC AIR POLLUTION SURVEY

MET. DATA SOLAR RADIATION

UNITS WATTS/m**2

STATION LINCOLN COUNTY

MONTH NOV 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	0	0	0	1	16	68	168	306	339	373	396	301	128	13	1	0	0	0	0	0	0	87.9
2	0	0	0	0	0	0	0	27	104	325	439	336	268	207	263	108	50	2	0	0	0	0	0	0	88.7
3	0	0	0	0	0	0	0	22	101	160	188	144	166	161	116	50	19	1	0	0	0	0	0	0	47.0
4	0	0	0	0	0	0	1	24	85	229	211	294	461	353	304	166	42	1	0	0	0	0	0	0	90.5
5	0	0	0	0	0	0	1	25	151	264	278	217	153	120	96	54	18	5	0	0	0	0	0	0	57.6
6	0	0	0	0	0	0	0	15	46	104	124	340	358	398	289	154	42	1	0	0	0	0	0	0	78.0
7	0	0	0	0	0	0	1	40	154	239	258	116	102	49	66	47	10	0	0	0	0	0	0	0	45.1
8	0	0	0	0	0	0	1	7	49	123	104	75	70	75	69	62	39	1	0	0	0	0	0	0	28.1
9	0	0	0	0	0	0	1	13	155	302	411	462	455	395	278	144	38	0	0	0	0	0	0	0	110.6
10	0	0	0	0	0	0	0	14	91	212	407	366	361	281	281	127	24	1	0	0	0	0	0	0	90.2
11	0	0	0	0	0	0	0	4	16	32	43	59	129	160	78	47	18	1	0	0	0	0	0	0	24.5
12	0	0	0	0	0	0	0	5	61	106	109	60	40	51	27	61	14	0	0	0	0	0	0	0	22.3
13	0	0	0	0	0	0	0	23	99	240	277	311	308	345	216	66	19	0	0	0	0	0	0	0	79.3
14	0	0	0	0	0	0	0	19	64	51	119	97	82	176	133	81	27	1	0	0	0	0	0	0	35.4
15	0	0	0	0	0	0	0	10	50	99	114	100	95	58	64	29	8	1	0	0	0	0	0	0	26.2
16	0	0	0	0	0	0	0	5	25	37	41	33	29	21	14	8	2	1	0	0	0	0	0	0	9.0
17	0	0	0	0	0	0	0	13	93	105	148	278	311	253	180	84	19	1	0	0	0	0	0	0	61.9
18	0	0	0	0	0	0	0	7	36	86	125	126	102	121	99	45	7	0	0	0	0	0	0	0	31.4
19	0	0	0	0	0	0	0	20	118	253	363	419	419	362	255	127	30	1	0	0	0	0	0	0	98.6
20	0	0	0	0	0	0	0	2	14	30	72	48	47	59	25	21	6	0	0	0	0	0	0	0	13.5
21	0	0	0	0	0	0	0	10	88	212	340	366	291	242	161	84	16	0	0	0	0	0	0	0	75.4
22	0	0	0	0	0	0	0	30	182	232	149	128	180	250	215	114	18	0	0	0	0	0	0	0	62.4
23	0	0	0	0	0	0	0	12	83	186	322	390	367	195	79	33	4	0	0	0	0	0	0	0	69.6
24	0	0	0	0	0	0	0	7	45	153	111	202	259	65	32	20	6	0	0	0	0	0	0	0	37.5
25	0	0	0	0	0	0	0	11	69	148	156	342	379	326	228	104	13	1	0	0	0	0	0	0	74.0
26	0	0	0	0	0	0	0	2	8	19	34	40	26	20	20	7	5	0	0	0	0	0	0	0	7.5
27	0	0	0	0	0	0	0	6	38	129	313	354	334	170	105	53	23	0	0	0	0	0	0	0	63.5
28	0	0	0	0	0	0	0	7	50	101	117	126	72	106	98	80	21	1	0	0	0	0	0	0	32.5
29	0	0	0	0	0	0	0	8	56	44	196	265	118	83	95	46	10	0	0	0	0	0	0	0	38.4
30	0	0	0	0	0	0	0	10	79	134	210	346	302	277	214	103	17	0	0	0	0	0	0	0	70.5
MEAN	0	0	0	0	0	0	0	14	76	151	203	226	222	193	147	75	19	1	0	0	0	0	0	0	55.2

PERCENTAGE OF DATA VALID 100.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 39770.00 TOTAL MONTHLY RECORD HOURS = 720.00

TABLE: F-96 OWNC AIR POLLUTION SURVEY

MET. DATA SOLAR RADIATION UNITS WATTS/m**2

STATION LINCOLN COUNTY MONTH DEC 1986

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	0	0	0	0	0	83	179	210	260	239	219	132	59	0	0	0	0	0	0	0	0	57.5
2	0	0	0	0	0	0	0	3	14	23	51	55	70	70	63	32	6	2	0	0	0	0	0	0	16.2
3	0	0	0	0	0	0	0	0	9	18	48	57	50	53	30	29	10	0	0	0	0	0	0	0	12.7
4	0	0	0	0	0	0	0	0	20	115	161	296	230	309	163	64	8	0	0	0	0	0	0	0	56.9
5	0	0	0	0	0	0	0	3	25	55	80	140	212	195	77	53	8	0	0	0	0	0	0	0	35.3
6	0	0	0	0	0	0	0	5	31	51	65	38	56	66	60	32	5	0	0	0	0	0	0	0	17.0
7	0	0	0	0	0	0	0	2	22	42	52	62	56	50	21	16	3	0	0	0	0	0	0	0	13.6
8	0	0	0	0	0	0	0	2	15	41	120	133	122	77	24	11	2	0	0	0	0	0	0	0	22.8
9	0	0	0	0	0	0	0	2	12	28	49	40	36	28	16	12	0	0	0	0	0	0	0	0	9.3
10	0	0	0	0	0	0	0	3	38	151	321	313	316	223	141	87	13	0	0	0	0	0	0	0	66.9
11	0	0	0	0	0	0	0	0	14	49	148	140	167	197	156	62	12	0	0	0	0	0	0	0	39.4
12	0	0	0	0	0	0	0	0	27	129	97	276	303	214	158	90	7	0	0	0	0	0	0	0	54.2
13	0	0	0	0	0	0	0	3	93	210	289	353	355	310	118	46	8	0	0	0	0	0	0	0	74.4
14	0	0	0	0	0	0	0	0	55	165	256	212	337	152	11	9	0	0	0	0	0	0	0	0	49.9
15	0	0	0	0	0	0	0	0	12	41	62	84	86	69	46	25	5	0	0	0	0	0	0	0	17.9
16	0	0	0	0	0	0	0	0	14	55	54	47	32	30	21	15	2	0	0	0	0	0	0	0	11.3
17	0	0	0	0	0	0	0	1	19	58	52	68	103	98	132	64	0	0	0	0	0	0	0	0	24.8
18	0	0	0	0	0	0	0	0	5	22	54	51	38	103	48	10	0	0	0	0	0	0	0	0	13.8
19	0	0	0	0	0	0	0	0	3	16	23	33	40	31	23	14	3	0	0	0	0	0	0	0	7.8
20	0	0	0	0	0	0	0	2	33	90	134	178	178	127	102	54	11	0	0	0	0	0	0	0	37.9
21	0	0	0	0	0	0	0	4	52	163	270	339	334	302	217	105	16	0	0	0	0	0	0	0	75.1
22	0	0	0	0	0	0	0	3	45	143	250	237	207	187	126	54	12	0	0	0	0	0	0	0	52.7
23	0	0	0	0	0	0	0	0	24	20	37	54	55	33	25	13	1	0	0	0	0	0	0	0	10.9
24	0	0	0	0	0	0	0	3	46	166	225	199	157	93	55	19	1	0	0	0	0	0	0	0	40.2
25	0	0	0	0	0	0	0	0	15	36	68	76	76	48	24	19	4	0	0	0	0	0	0	0	15.3
26	0	0	0	0	0	0	0	1	15	33	85	110	135	103	65	30	7	0	0	0	0	0	0	0	24.3
27	0	0	0	0	0	0	0	1	9	21	32	42	50	52	33	16	4	0	0	0	0	0	0	0	10.8
28	0	0	0	0	0	0	0	3	34	54	93	100	112	91	71	36	7	0	0	0	0	0	0	0	25.0
29	0	0	0	0	0	0	0	0	9	37	74	87	106	90	105	80	20	0	0	0	0	0	0	0	25.3
30	0	0	0	0	0	0	0	0	10	47	44	29	44	27	17	11	0	0	0	0	0	0	0	0	9.5
31	0	0	0	0	0	0	0	0	8	20	33	87	87	94	53	21	3	0	0	0	0	0	0	0	16.9
MEAN	0	0	0	0	0	0	0	1	26	74	114	135	142	121	75	38	6	0	0	0	0	0	0	0	30.5

PERCENTAGE OF DATA VALID 100.0 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 22694.00 TOTAL MONTHLY RECORD HOURS = 744.00

TABLE: F-97

OWMC AIR POLLUTION SURVEY

MET. DATA SOLAR RADIATION

UNITS WATTS/m**2

STATION LINCOLN COUNTY

MONTH JAN 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	0	0	0	0	1	24	63	110	88	95	83	46	34	9	0	0	0	0	0	0	0	23.0
2	0	0	0	0	0	0	0	0	29	76	82	129	120	90	98	69	29	0	0	0	0	0	0	0	30.1
3	0	0	0	0	0	0	0	8	43	162	302	362	422	415	282	140	56	0	0	0	0	0	0	0	91.3
4	0	0	0	0	0	0	0	2	32	86	146	237	259	385	295	148	31	0	0	0	0	0	0	0	67.5
5	0	0	0	0	0	0	0	3	94	247	189	250	404	285	158	115	38	0	0	0	0	0	0	0	74.3
6	0	0	0	0	0	0	0	1	55	142	180	169	174	186	132	70	15	0	0	0	0	0	0	0	46.8
7	0	0	0	0	0	0	0	0	0	36	89	176	156	89	76	72	16	0	0	0	0	0	0	0	29.6
8	0	0	0	0	0	0	0	4	14	44	67	105	159	111	104	52	13	0	0	0	0	0	0	0	28.0
9	0	0	0	0	0	0	0	1	12	34	78	140	144	73	23	33	10	0	0	0	0	0	0	0	22.8
10	0	0	0	0	0	0	0	2	20	44	77	123	117	92	78	50	17	0	0	0	0	0	0	0	25.8
11	0	0	0	0	0	0	0	2	15	103	170	165	196	172	96	74	17	3	0	0	0	0	0	0	42.2
12	0	0	0	0	0	0	0	1	16	51	142	133	56	79	84	43	15	2	0	0	0	0	0	0	25.9
13	0	0	0	0	0	0	0	2	30	101	191	271	328	254	231	157	48	0	0	0	0	0	0	0	67.2
14	0	0	0	0	0	0	0	2	53	169	278	293	328	249	138	102	33	1	0	0	0	0	0	0	68.6
15	0	0	0	0	0	0	0	0	3	9	24	30	62	85	55	62	22	0	0	0	0	0	0	0	14.7
16	0	0	0	0	0	0	0	3	67	106	204	242	358	169	98	99	32	1	0	0	0	0	0	0	57.5
17	0	0	0	0	0	0	0	5	52	144	242	278	339	258	124	63	19	2	0	0	0	0	0	0	63.6
18	0	0	0	0	0	0	0	4	14	37	45	78	78	97	71	79	26	0	0	0	0	0	0	0	22.0
19	0	0	0	0	0	0	0	0	16	49	69	83	56	43	56	49	9	0	0	0	0	0	0	0	17.9
20	0	0	0	0	0	0	0	0	52	139	267	367	381	395	220	102	41	3	0	0	0	0	0	0	82.0
21	0	0	0	0	0	0	0	4	32	196	330	413	438	381	220	109	59	4	0	0	0	0	0	0	91.1
22	0	0	0	0	0	0	0	2	40	103	146	172	168	147	129	80	27	3	0	0	0	0	0	0	42.4
23	0	0	0	0	0	0	0	3	65	176	334	378	346	316	312	199	46	2	0	0	0	0	0	0	90.7
24	0	0	0	0	0	0	0	5	72	209	344	427	450	413	321	193	69	4	0	0	0	0	0	0	104.5
25	0	0	0	0	0	0	0	6	74	210	344	428	453	422	331	198	70	5	0	0	0	0	0	0	105.9
26	0	0	0	0	0	0	0	6	41	118	272	314	365	270	267	144	58	4	0	0	0	0	0	0	77.5
27	0	0	0	0	0	0	0	10	119	220	315	321	309	293	216	149	49	3	0	0	0	0	0	0	83.5
28	0	0	0	0	0	0	0	1	58	83	64	170	187	219	170	111	43	3	0	0	0	0	0	0	46.2
29	0	0	0	0	0	0	0	8	75	181	312	345	448	401	345	176	50	5	0	0	0	0	0	0	97.8
30	0	0	0	0	0	0	0	3	19	47	94	133	154	130	167	102	44	9	0	0	0	0	0	0	37.6
31	0	0	0	0	0	0	0	3	30	145	239	324	385	451	356	216	88	7	0	0	0	0	0	0	93.5
MEAN	0	0	0	0	0	0	0	3	41	114	185	231	256	228	171	106	36	2	0	0	0	0	0	0	57.1

PERCENTAGE OF DATA VALID 100.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 42515.00 TOTAL MONTHLY RECORD HOURS = 744.00

TABLE: F-98 OWMC AIR POLLUTION SURVEY

MET. DATA SOLAR RADIATION UNITS WATTS/m**2

STATION LINCOLN COUNTY MONTH FEB 1987

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	0	0	0	0	8	60	85	121	191	196	280	274	201	96	11	0	0	0	0	0	0	63.5
2	0	0	0	0	0	0	0	6	52	138	120	168	191	173	108	85	56	8	0	0	0	0	0	0	46.0
3	0	0	0	0	0	0	0	3	17	24	71	169	245	249	149	89	36	1	0	0	0	0	0	0	43.9
4	0	0	0	0	0	0	0	4	64	171	212	265	211	185	173	169	69	11	0	0	0	0	0	0	63.9
5	0	0	0	0	0	0	0	6	77	205	316	385	396	349	302	204	90	13	0	0	0	0	0	0	97.6
6	0	0	0	0	0	0	0	0	52	99	150	319	356	298	324	252	95	4	0	0	0	0	0	0	81.2
7	0	0	0	0	0	0	0	7	52	123	227	389	508	406	150	115	53	17	0	0	0	0	0	0	85.3
8	0	0	0	0	0	0	0	2	11	24	125	185	183	177	192	58	16	7	0	0	0	0	0	0	40.8
9	0	0	0	0	0	0	0	11	113	278	423	511	542	507	420	235	96	18	0	0	0	0	0	0	131.4
10	0	0	0	0	0	0	0	4	72	145	220	211	235	338	19	53	42	9	0	0	0	0	0	0	56.2
11	0	0	0	0	0	0	0	12	103	233	258	336	310	335	366	169	98	21	0	0	0	0	0	0	93.4
12	0	0	0	0	0	0	0	9	51	126	189	304	422	297	297	150	59	13	0	0	0	0	0	0	79.9
13	0	0	0	0	0	0	12	33	95	251	379	461	485	408	281	124	90	19	0	0	0	0	0	0	109.9
14	0	0	0	0	0	0	0	21	80	225	297	269	390	368	262	210	80	82	0	0	0	0	0	0	95.2
15	0	0	0	0	0	0	0	26	116	229	338	500	378	397	365	256	134	50	0	0	0	0	0	0	116.2
16	0	0	0	0	0	0	0	23	145	264	364	403	403	327	380	278	141	27	0	0	0	0	0	0	114.8
17	0	0	0	0	0	0	0	21	126	314	461	508	558	503	376	184	85	32	0	0	0	0	0	0	132.0
18	0	0	0	0	0	0	0	42	127	255	388	454	477	413	339	255	127	38	0	0	0	0	0	0	121.5
19	0	0	0	0	0	0	0	47	158	259	344	417	445	452	349	258	126	39	0	0	0	0	0	0	120.6
20	0	0	0	0	0	0	0	49	166	276	373	411	447	429	364	250	130	50	0	0	0	0	0	0	122.7
21	0	0	0	0	0	0	0	43	154	208	269	389	411	395	347	222	129	51	0	0	0	0	0	0	109.1
22	0	0	0	0	0	0	0	36	89	148	150	250	168	236	120	104	72	18	0	0	0	0	0	0	58.0
23	0	0	0	0	0	0	0	20	52	106	164	201	148	180	180	184	104	48	0	0	0	0	0	0	57.8
24	0	0	0	0	0	0	0	53	174	288	343	418	488	426	371	262	141	52	0	0	0	0	0	0	125.7
25	0	0	0	0	0	0	0	41	142	274	350	395	414	397	362	265	142	53	0	0	0	0	0	0	118.1
26	0	0	0	0	0	0	0	44	165	235	319	321	383	363	299	205	122	50	0	0	0	0	0	0	104.4
27	0	0	0	0	0	0	0	24	106	178	286	365	396	327	329	247	106	51	0	0	0	0	0	0	100.6
28	0	0	0	0	0	0	0	18	44	71	120	199	158	127	86	51	45	18	0	0	0	0	0	0	39.0
MEAN	0	0	0	0	0	0	0	22	95	187	264	336	355	334	271	183	92	29	0	0	0	0	0	0	90.3

PERCENTAGE OF DATA VALID 100.0 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 60687.00 TOTAL MONTHLY RECORD HOURS = 672.00

TABLE: F-99

OWMC AIR POLLUTION SURVEY

MET. DATA SOLAR RADIATION

UNITS WATTS/m**2

STATION LINCOLN COUNTY

MONTH MAR 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	0	0	0	0	14	39	19	94	57	38	103	130	91	52	9	0	0	0	0	0	0	26.9
2	0	0	0	0	0	0	0	11	54	157	164	175	375	201	105	145	89	40	3	0	0	0	0	0	63.3
3	0	0	0	0	0	0	0	19	77	174	271	375	421	427	156	135	71	18	3	0	0	0	0	0	89.5
4	0	0	0	0	0	0	4	60	135	144	292	386	273	326	227	191	116	24	1	0	0	0	0	0	90.8
5	0	0	0	0	0	0	8	48	113	251	290	261	206	206	322	287	174	51	0	0	0	0	0	0	92.4
6	0	0	0	0	0	0	3	54	212	343	482	549	561	526	442	315	157	30	7	0	0	0	0	0	153.4
7	0	0	0	0	0	0	8	54	170	340	475	504	532	549	468	335	191	60	0	0	0	0	0	0	153.6
8	0	0	0	0	0	0	2	63	199	370	518	542	540	515	450	327	178	45	0	0	0	0	0	0	156.2
9	0	0	0	0	0	0	0	6	15	35	52	73	214	150	382	311	179	57	1	0	0	0	0	0	61.5
10	0	0	0	0	0	0	0	37	97	150	268	444	444	420	365	276	166	60	8	0	0	0	0	0	114.0
11	0	0	0	0	0	0	1	61	179	261	372	447	475	435	280	212	141	52	0	0	0	0	0	0	121.5
12	0	0	0	0	0	0	0	36	107	259	323	478	365	308	315	183	70	31	0	0	0	0	0	0	103.1
13	0	0	0	0	0	0	0	59	169	273	334	285	219	276	337	153	133	34	2	0	0	0	0	0	94.8
14	0	0	0	0	0	0	0	26	87	153	220	297	305	214	162	100	48	15	0	0	0	0	0	0	67.8
15	0	0	0	0	0	0	0	55	163	263	326	362	374	366	325	249	146	53	6	0	0	0	0	0	112.0
16	0	0	0	0	0	0	0	68	170	256	328	367	381	365	325	253	147	60	11	0	0	0	0	0	113.8
17	0	0	0	0	0	0	8	62	167	265	328	379	452	390	310	237	140	53	7	0	0	0	0	0	116.6
18	0	0	0	0	0	0	8	69	170	262	332	449	695	682	595	460	293	123	0	0	0	0	0	0	172.4
19	0	0	0	0	0	0	10	68	166	247	318	468	383	363	319	249	148	58	7	0	0	0	0	0	116.8
20	0	0	0	0	0	0	7	70	172	310	348	443	498	473	368	252	172	55	1	0	0	0	0	0	132.0
21	0	0	0	0	0	0	5	55	248	376	481	487	502	515	415	325	184	90	9	0	0	0	0	0	153.8
22	0	0	0	0	0	0	14	106	255	385	486	548	562	533	448	352	218	88	9	0	0	0	0	0	166.8
23	0	0	0	0	0	0	13	120	248	361	460	521	522	498	471	462	136	21	0	0	0	0	0	0	159.7
24	0	0	0	0	0	0	13	123	296	476	609	702	729	689	602	469	309	143	24	0	0	0	0	0	216.0
25	0	0	0	0	0	0	3	16	103	69	83	72	442	522	429	189	56	8	0	0	0	0	0	0	83.0
26	0	0	0	0	0	0	0	49	69	176	402	489	269	256	103	43	76	23	0	0	0	0	0	0	81.5
27	0	0	0	0	0	0	0	43	63	89	103	183	243	263	163	136	203	23	0	0	0	0	0	0	63.0
28	0	0	0	0	0	0	0	23	129	336	569	589	556	522	449	336	229	96	23	0	0	0	0	0	160.7
29	0	0	0	0	0	0	23	120	316	382	589	675	649	629	442	329	256	103	3	0	0	0	0	0	188.2
30	0	0	0	0	0	0	0	3	13	23	19	13	27	36	69	23	23	3	0	0	0	0	0	0	10.5
31	0	0	0	0	0	0	0	23	50	125	162	187	336	293	308	222	240	98	13	0	0	0	0	0	85.7
MEAN	0	0	0	0	0	0	4	52	144	237	326	381	406	389	332	247	153	52	4	0	0	0	0	0	113.6

PERCENTAGE OF DATA VALID 100.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 84508.00 TOTAL MONTHLY RECORD HOURS = 744.00

TABLE: F-100 OWMC AIR POLLUTION SURVEY

MET. DATA SOLAR RADIATION UNITS WATTS/m**2

STATION LINCOLN COUNTY MONTH APR 1987

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	0	0	1	46	163	366	469	665	803	777	565	519	280	153	34	4	0	0	0	0	0	201.9
2	0	0	0	0	0	0	27	37	277	449	238	398	255	295	336	201	115	47	8	0	0	0	0	0	111.8
3	0	0	0	0	0	1	42	201	382	542	493	534	513	590	554	390	280	101	16	0	0	0	0	0	193.3
4	0	0	0	0	0	0	14	51	94	137	129	161	102	108	62	31	25	8	2	0	0	0	0	0	38.5
5	0	0	0	0	0	0	2	45	136	299	141	46	95	33	427	63	52	43	30	4	0	0	0	0	59.0
6	0	0	0	0	0	0	0	6	33	55	71	91	98	70	90	114	84	59	22	5	0	0	0	0	33.3
7	0	0	0	0	0	0	3	75	273	431	581	720	801	812	769	679	540	348	154	28	0	0	0	0	258.9
8	0	0	0	0	0	0	3	64	227	416	573	704	803	744	676	488	181	191	66	16	0	0	0	0	214.7
9	0	0	0	0	0	0	3	67	235	433	596	726	718	693	730	659	540	349	158	31	0	0	0	0	247.4
10	0	0	0	0	0	0	4	69	235	430	590	716	795	805	762	664	517	319	130	27	0	0	0	0	252.6
11	0	0	0	0	0	0	4	70	241	416	587	721	520	445	729	442	349	34	34	19	0	0	0	0	192.1
12	0	0	0	0	0	0	2	37	71	52	55	45	39	55	57	40	42	22	11	1	0	0	0	0	22.0
13	0	0	0	0	0	0	5	79	250	455	610	733	810	818	765	677	533	302	111	22	0	0	0	0	257.1
14	0	0	0	0	0	0	8	80	136	390	315	741	814	792	710	298	88	60	37	7	0	0	0	0	186.5
15	0	0	0	0	0	0	1	31	109	175	119	135	246	304	490	361	166	41	25	7	0	0	0	0	92.1
16	0	0	0	0	0	0	2	19	60	160	251	285	317	340	394	385	580	369	187	39	0	0	0	0	141.2
17	0	0	0	0	0	0	1	34	53	131	159	172	128	195	263	220	256	386	163	41	1	0	0	0	91.8
18	0	0	0	0	0	0	8	77	190	429	634	544	565	763	799	674	464	362	195	57	1	0	0	0	240.1
19	0	0	0	0	0	0	9	92	259	443	605	727	808	840	803	719	586	402	203	53	1	0	0	0	272.9
20	0	0	0	0	0	0	9	90	271	461	617	738	829	846	805	708	565	389	158	31	2	0	0	0	271.6
21	0	0	0	0	0	0	9	91	247	401	598	721	795	810	736	561	442	282	117	21	0	0	0	0	243.0
22	0	0	0	0	0	0	2	15	97	265	287	328	317	356	383	425	537	273	130	29	1	0	0	0	143.5
23	0	0	0	0	0	0	4	38	132	221	387	294	118	64	87	172	156	60	27	8	1	0	0	0	73.7
24	0	0	0	0	0	0	1	11	54	112	290	467	495	535	635	582	553	419	192	45	3	0	0	0	183.1
25	0	0	0	0	0	0	14	117	310	499	654	788	869	883	842	752	609	419	225	48	2	0	0	0	293.0
26	0	0	0	0	0	0	10	65	196	429	600	787	864	877	832	741	605	421	221	63	3	0	0	0	279.8
27	0	0	0	0	0	0	15	117	299	514	648	775	842	728	416	155	42	18	11	4	0	0	0	0	191.0
28	0	0	0	0	0	0	5	39	71	309	295	174	159	455	491	506	203	115	122	28	1	0	0	0	123.9
29	0	0	0	0	0	0	10	83	213	164	228	604	686	745	710	746	615	428	215	58	2	0	0	0	229.5
30	0	0	0	0	0	0	8	39	200	205	303	394	403	475	782	681	565	301	210	66	3	0	0	0	193.1
MEAN	0	0	0	0	0	0	9	67	191	330	411	502	519	535	555	447	348	220	106	25	1	0	0	0	171.71

PERCENTAGE OF DATA VALID 100.0 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 127973.00 TOTAL MONTHLY RECORD HOURS = 720.00

TABLE: F-101

OWMC AIR POLLUTION SURVEY

MET. DATA SOLAR RADIATION

UNITS WATTS/m**2

STATION LINCOLN COUNTY

MONTH MAY 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	0	0	0	24	135	343	480	675	796	869	882	833	740	601	415	216	63	3	0	0	0	294.8
2	0	0	0	0	0	0	37	132	342	527	674	775	842	772	789	695	269	389	203	56	16	0	0	0	271.6
3	0	0	0	0	0	0	3	49	103	146	189	216	336	309	269	349	416	416	243	69	16	0	0	0	130.4
4	0	0	0	0	0	0	28	154	352	538	688	812	877	889	851	766	631	447	244	80	5	0	0	0	306.8
5	0	0	0	0	0	0	26	154	353	539	692	817	889	897	855	764	612	426	226	68	4	0	0	0	305.1
6	0	0	0	0	0	0	33	155	351	538	627	775	851	842	781	730	563	409	216	59	5	0	0	0	289.0
7	0	0	0	0	0	0	21	148	323	316	448	669	867	885	823	746	353	309	170	54	6	0	0	0	255.8
8	0	0	0	0	0	0	31	165	362	547	696	824	889	793	833	772	594	427	202	80	7	0	0	0	300.9
9	0	0	0	0	0	0	30	85	306	483	644	762	837	861	816	698	524	422	216	56	16	0	0	0	281.5
10	0	0	0	0	0	0	3	16	189	509	642	735	815	815	749	682	575	389	203	56	16	0	0	0	266.4
11	0	0	0	0	0	0	29	96	203	469	625	743	822	754	634	653	535	344	166	21	0	0	0	0	253.9
12	0	0	0	0	0	0	17	111	308	549	697	819	890	899	853	763	634	452	250	85	7	0	0	0	305.6
13	0	0	0	0	0	0	35	179	382	561	708	835	899	904	868	777	636	458	258	89	8	0	0	0	316.5
14	0	0	0	0	0	1	27	122	223	340	544	711	804	818	773	595	373	362	89	55	11	0	0	0	243.7
15	0	0	0	0	0	0	19	137	360	537	699	816	879	887	862	776	639	457	254	84	10	0	0	0	309.0
16	0	0	0	0	0	0	39	184	381	558	706	832	893	900	868	764	617	391	249	84	9	0	0	0	311.5
17	0	0	0	0	0	1	38	172	363	534	675	789	842	855	829	735	602	442	243	96	9	0	0	0	301.0
18	0	0	0	0	0	1	28	88	20	49	73	145	200	75	118	176	92	57	28	25	3	0	0	0	49.1
19	0	0	0	0	0	2	26	60	147	249	412	634	639	668	540	419	370	159	95	24	3	0	0	0	185.3
20	0	0	0	0	0	1	17	56	122	185	317	434	301	402	493	467	303	199	123	43	6	0	0	0	144.5
21	0	0	0	0	0	1	22	49	100	159	262	497	856	859	806	738	584	372	212	69	10	0	0	0	233.2
22	0	0	0	0	0	2	22	85	217	293	630	731	598	62	433	359	540	427	214	69	12	0	0	0	195.6
23	0	0	0	0	0	3	23	90	277	391	641	581	318	362	306	423	325	110	61	22	2	0	0	0	164.0
24	0	0	0	0	0	3	41	191	343	296	254	226	248	300	242	227	183	117	68	28	5	0	0	0	115.5
25	0	0	0	0	0	4	54	146	247	212	329	260	320	357	597	652	462	351	187	86	10	0	0	0	178.1
26	0	0	0	0	0	2	27	55	75	167	154	179	404	550	433	508	437	387	186	107	16	0	0	0	153.6
27	0	0	0	0	0	3	36	95	189	339	575	775	852	871	845	764	621	449	249	111	29	0	0	0	283.5
28	0	0	0	0	0	3	39	159	328	497	659	784	858	870	706	379	138	357	202	84	11	0	0	0	253.1
29	0	0	0	0	0	3	38	167	351	524	649	786	641	605	818	717	568	409	232	90	12	0	0	0	275.4
30	0	0	0	0	0	4	46	173	342	488	628	735	801	832	836	747	456	428	156	30	3	0	0	0	279.4
31	0	0	0	0	0	3	24	51	101	151	186	135	198	623	696	428	358	339	241	79	15	0	0	0	151.2
MEAN	0	0	0	0	0	1	29	118	261	393	529	633	688	690	682	613	471	359	190	65	9	0	0	0	238.9

PERCENTAGE OF DATA VALID 100.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 177712.00 TOTAL MONTHLY RECORD HOURS = 744.00

TABLE: F-102

OWMC AIR POLLUTION SURVEY

MET. DATA PRECIPITATION

UNITS 0.01 m

STATION LINCOLN COUNTY

MONTH JUN 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL
1	25	0	0	0	0	0	0	0	0	0	0	0	0	0	275	0	1125	225	0	475	175	0	0	0	2300.0
2	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25.0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
5	0	0	0	0	0	0	0	0	0	25	175	300	150	25	0	0	50	25	0	0	0	0	0	0	750.0
6	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	25.0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
8	250	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	350.0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	300	400	225	125	25	0	0	1075.0
12	0	25	175	250	125	75	0	0	0	50	50	0	0	0	0	0	0	0	0	0	0	0	0	0	750.0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
15	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25.0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
22	0	0	0	0	0	0	0	300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	125	0	425.0
24	0	0	0	0	0	350	125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	475.0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
27	0	0	0	0	0	0	0	0	0	0	0	475	200	0	150	0	0	0	0	0	0	0	0	0	825.0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	450	0	0	0	0	0	450.0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
MEAN	10.0	0.8	9.2	8.3	4.2	14.2	4.2	10.0	0.8	2.5	7.5	26.7	11.7	0.8	14.2	0.0	39.2	18.3	28.3	23.3	10.0	0.8	4.2	0.0	10.4
																								TOTAL	7475

PERCENTAGE OF DATA VALID 100.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 7475.00 TOTAL MONTHLY RECORD HOURS = 720.00

TABLE: F-103

OWMC AIR POLLUTION SURVEY

MET. DATA PRECIPITATION

UNITS 0.01 m

STATION LINCOLN COUNTY

MONTH JUL 1986

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
2	0	0	0	75	25	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	125.0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1075	0	0	0	0	0	0	0	1075.0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	0	0	0	0	0	0	0	0	50.0
12	0	0	75	875	650	800	175	0	150	50	0	0	0	0	0	0	0	0	0	0	0	0	25	300	3100.0
13	225	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75	0	0	0	0	0	0	425	175	900.0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
17	0	0	0	0	0	0	0	0	0	0	1175	150	0	0	0	0	0	0	0	0	0	0	0	0	1325.0
18	0	200	0	0	0	75	50	0	0	0	0	0	0	0	0	0	0	0	0	575	550	0	0	150	1600.0
19	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25.0
20	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	100.0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	50.0
26	0	25	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	75.0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
29	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25.0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
MEAN	8.1	7.3	2.4	30.6	23.4	28.2	8.1	0.0	4.8	1.6	37.9	8.1	0.0	0.0	0.0	4.0	34.7	0.0	0.0	19.4	17.7	0.0	14.5	21.8	11.4
																								TOTAL	8450

PERCENTAGE OF DATA VALID 100.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 8450.00 TOTAL MONTHLY RECORD HOURS = 744.00

TABLE: F-104

OWMC AIR POLLUTION SURVEY

MET. DATA PRECIPITATION

UNITS 0.01 m

STATION LINCOLN COUNTY

MONTH AUG 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL
1	0	0	0	0	0	0	75	0	0	200	25	1025	475	0	0	0	0	0	0	0	0	0	0	0	1800.0
2	0	0	0	0	0	0	0	0	0	0	0	0	125	0	0	0	0	0	0	0	0	0	0	0	125.0
3	0	0	0	0	0	0	75	0	0	0	0	0	0	0	0	0	50	0	0	0	0	0	0	0	125.0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
7	75	0	275	1600	125	150	0	25	150	350	25	0	0	0	0	0	0	100	0	0	0	0	0	0	2875.0
8	0	0	0	0	0	0	0	50	0	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	250.0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	250	0	25	175	0	75	125	75	50	775.0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	575	0	0	0	0	0	0	0	0	0	0	575.0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
23	0	0	0	0	0	25	100	0	0	125	0	0	0	0	875	25	0	475	0	0	0	0	0	0	1625.0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	400	275	0	0	0	0	675.0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	125	0	125	0	0	0	0	0	0	250.0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
MEAN	2.4	0.0	8.9	51.6	4.0	5.6	8.1	2.4	4.8	28.2	1.6	33.1	19.4	18.5	28.2	12.9	1.6	23.4	18.5	8.9	2.4	4.0	2.4	1.6	12.2
																								TOTAL	9075

PERCENTAGE OF DATA VALID 100.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 9075.00 TOTAL MONTHLY RECORD HOURS = 744.00

TABLE: F-105

OWMC AIR POLLUTION SURVEY

MET. DATA PRECIPITATION

UNITS 0.01 m

STATION LINCOLN COUNTY

MONTH SEP 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL
1											DATA MISSING														
2	****	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
4	0	0	0	0	0	0	0	0	0	0	0	0	25	0	50	75	0	0	0	0	0	0	0	0	150.0
5	0	575	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	600.0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
7	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25.0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
9	0	0	0	0	0	0	0	0	0	0	0	0	25	150	0	0	0	0	0	25	0	0	0	0	200.0
10	0	0	0	100	750	100	125	250	100	150	0	0	0	100	150	25	75	75	75	0	25	0	0	50	2150.0
11	50	50	0	0	125	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	250.0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
14	0	0	0	0	0	0	0	25	50	75	75	50	200	150	50	0	0	0	0	75	300	75	0	0	1125.0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
19	0	0	50	0	0	0	150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	200.0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	25.0
23	0	0	25	0	0	425	150	75	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	700.0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	350	0	0	0	0	0	0	0	0	350.0
26	0	0	0	0	0	0	25	0	0	0	0	0	0	0	125	0	0	0	0	0	0	0	0	0	150.0
27	0	0	0	0	0	0	25	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50.0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
29	0	0	0	0	0	0	375	25	1500	100	0	0	0	825	****	0	0	0	0	0	0	75	0	0	2900.0
30	0	0	50	0	0	0	0	0	0	0	0	0	0	0	25	50	0	100	0	0	0	25	0	0	250.0
MEAN	1.8	21.6	4.3	3.4	30.2	18.1	31.0	14.7	56.9	11.2	3.4	1.7	8.6	42.2	14.3	17.2	2.6	6.0	2.6	3.4	11.2	6.0	0.0	2.6	13.1
																								TOTAL	9125

PERCENTAGE OF DATA VALID 96.4

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 9125.00 TOTAL MONTHLY RECORD HOURS = 694.00

TABLE: F-106

OWMC AIR POLLUTION SURVEY

MET. DATA PRECIPITATION

UNITS 0.01 m

STATION LINCOLN COUNTY

MONTH OCT 1986

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
3	0	0	0	0	0	0	0	50	25	150	75	100	50	50	75	125	0	75	375	0	0	0	0	0	1150.0
4	0	0	0	0	0	0	0	0	0	0	0	0	25	325	100	0	100	0	0	25	0	0	50	0	625.0
5	0	25	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	75.0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	25.0
9	50	25	350	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	450.0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	25	0	0	75.0
13	50	175	50	300	175	150	100	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1025.0
14	0	50	50	0	75	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	225.0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	25.0
17	0	25	0	0	0	0	0	0	0	0	75	75	0	0	0	0	0	0	0	0	0	0	0	0	175.0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
22	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25.0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
26	0	0	150	175	100	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	450.0
27	0	0	0	0	0	0	0	0	0	0	0	0	25	50	75	75	100	0	0	25	0	0	0	0	350.0
28	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	25.0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	100	25	0	0	0	0	0	0	0	150.0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
31	DATA MISSING																								
MEAN	3.3	10.0	20.0	16.7	12.5	7.5	3.3	2.5	0.8	5.8	5.0	6.7	3.3	14.2	10.0	10.0	7.5	2.5	12.5	1.7	2.5	0.8	2.5	0.0	6.7
																								TOTAL	4850

PERCENTAGE OF DATA VALID 96.8

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 4850.00 TOTAL MONTHLY RECORD HOURS = 720.00

TABLE: F-107

OWMC AIR POLLUTION SURVEY

MET. DATA PRECIPITATION

UNITS 0.01 m

STATION LINCOLN COUNTY

MONTH NOV 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	125	125	225	200	175	875.0
2	100	75	125	50	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	375.0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
8	0	0	0	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	0	100.0
9	25	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50.0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
11	0	0	0	0	50	0	0	25	25	75	75	125	375	0	0	0	0	0	0	0	0	0	0	0	750.0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	25.0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	25.0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	25	0	0	0	0	0	0	50.0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	25	0	25	50	25	0	0	25	25	200.0
21	0	0	75	50	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	175.0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
26	0	0	0	0	0	200	325	150	375	200	250	25	50	75	75	75	25	225	150	75	0	0	0	0	2275.0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
MEAN	4.2	2.5	6.7	3.3	4.2	7.5	12.5	5.8	13.3	9.2	10.8	5.0	14.2	3.3	3.3	4.2	0.8	9.2	7.5	7.5	4.2	7.5	9.2	7.5	6.8
																								TOTAL	4900

PERCENTAGE OF DATA VALID 100.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 4900.00 TOTAL MONTHLY RECORD HOURS = 720.00

TABLE: F-108 OWMC AIR POLLUTION SURVEY

MET. DATA PRECIPITATION UNITS 0.01 m

STATION LINCOLN COUNTY MONTH DEC 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
2	0	0	0	0	50	25	100	150	175	350	350	225	175	200	100	25	0	50	25	50	50	25	0	0	2125.0
3	0	0	0	0	0	0	25	100	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	150.0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	25.0
7	0	0	0	0	0	0	0	0	0	0	50	0	25	0	25	50	75	25	0	0	0	0	0	0	250.0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
9	0	0	0	0	0	0	0	0	25	50	0	0	100	50	150	100	125	325	100	0	0	0	0	0	1025.0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
18	0	0	0	25	25	100	25	50	75	25	0	0	0	0	0	0	0	0	50	25	0	0	0	0	400.0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	0	25	125	125	125	275	425	275	1425.0
25	0	0	0	25	25	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75.0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
MEAN	0.0	0.0	0.0	1.6	3.2	4.8	4.8	9.7	9.7	13.7	12.9	7.3	9.7	8.1	9.7	7.3	6.5	13.7	9.7	6.5	5.6	9.7	13.7	8.9	7.4
																								TOTAL	5475

PERCENTAGE OF DATA VALID 100.0 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 5475.00 TOTAL MONTHLY RECORD HOURS = 744.00

TABLE: F-109

OWMC AIR POLLUTION SURVEY

MET. DATA PRECIPITATION

UNITS 0.01 m

STATION LINCOLN COUNTY

MONTH JAN 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	25	25	0	25	0	125.0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
10	0	0	0	0	0	0	0	25	0	0	0	0	0	50	50	0	0	0	0	0	0	0	0	0	125.0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	25.0
15	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50.0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
18	0	0	0	0	0	25	0	0	25	50	100	75	25	0	0	0	0	0	0	0	0	0	0	0	300.0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	25	25	25	0	0	100.0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
26	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25.0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
28	0	0	0	0	0	0	0	0	0	0	25	25	0	0	0	0	0	0	0	0	0	0	0	0	50.0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
30	0	0	0	25	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50.0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
MEAN	0.0	0.0	1.6	0.8	0.8	0.8	0.8	0.8	0.8	1.6	4.0	3.2	0.8	1.6	1.6	0.0	0.0	0.8	1.6	1.6	2.4	0.8	0.8	0.0	1.1
																								TOTAL	850

PERCENTAGE OF DATA VALID 100.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 850.00 TOTAL MONTHLY RECORD HOURS = 744.00

TABLE: F-110

OWMC AIR POLLUTION SURVEY

MET. DATA PRECIPITATION

UNITS 0.01 m

STATION LINCOLN COUNTY

MONTH FEB 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	25.0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
8	0	0	0	0	0	0	0	0	0	0	25	25	0	0	0	75	0	0	0	0	0	0	0	0	125.0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
28	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	25	75	25	150.0
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.9	0.9	0.0	0.0	0.0	2.7	0.0	0.0	0.0	0.0	0.0	0.9	2.7	1.8	0.4
																								TOTAL	300

PERCENTAGE OF DATA VALID 100.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 300.00 TOTAL MONTHLY RECORD HOURS = 672.00

TABLE: F-111

OWMC AIR POLLUTION SURVEY

MET. DATA PRECIPITATION

UNITS 0.01 m

STATION LINCOLN COUNTY

MONTH MAR 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL
1	0	100	175	75	50	0	0	0	0	125	450	0	75	25	25	25	0	0	0	25	0	0	25	0	1175.0
2	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25.0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
13	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25.0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
18	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25.0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
25	0	0	0	0	0	0	50	0	0	0	100	175	75	0	0	0	0	0	0	0	0	0	0	0	0.0
26	150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	275	0	0	0	675.0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	150.0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	25.0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
30	0	0	0	0	0	50	75	75	25	200	175	75	150	175	50	175	100	75	25	75	25	50	25	0	1600.0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
MEAN	6.5	3.2	5.6	2.4	1.6	1.6	4.8	2.4	0.8	10.5	23.4	8.1	9.7	6.5	2.4	6.5	3.2	2.4	0.8	3.2	10.5	1.6	1.6	0.0	5.0
																							TOTAL		3700

PERCENTAGE OF DATA VALID 100.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 3700.00 TOTAL MONTHLY RECORD HOURS = 744.00

TABLE: F-112 OWMC AIR POLLUTION SURVEY

MET. DATA PRECIPITATION UNITS 0.01 m

STATION LINCOLN COUNTY MONTH APR 1987

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL
1	0	0	0	0	0	0	0	0	0	0	0	25	0	0	75	100	0	0	0	0	0	0	0	0	200.0
2	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50.0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
4	0	0	0	0	0	0	0	0	0	50	75	25	75	125	175	250	125	0	0	0	25	0	0	100	1025.0
5	50	50	0	25	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	25	0	0	50	150	375.0
6	75	75	100	50	25	0	0	50	25	0	0	0	0	0	25	50	25	100	200	150	0	100	75	25	1150.0
7	25	50	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100.0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	25.0
12	0	0	0	0	0	0	0	0	0	0	75	100	225	150	300	75	25	0	0	0	0	0	0	0	950.0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	50	0	0	0	0	75.0
15	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	25	25	0	0	0	0	0	75.0
16	0	25	25	25	25	25	25	0	50	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	225.0
17	0	0	0	0	0	0	50	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	75.0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
23	0	0	0	0	0	0	0	0	0	0	0	0	200	175	0	25	0	0	0	25	0	0	0	0	425.0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	75	250	0	0	0	0	375.0
28	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25.0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
MEAN	6.7	6.7	5.0	3.3	1.7	0.8	2.5	1.7	3.3	2.5	5.8	5.8	16.7	15.0	20.0	16.7	5.8	6.7	10.8	16.7	0.8	3.3	4.2	9.2	7.2
																								TOTAL	5150

PERCENTAGE OF DATA VALID 100.0 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 5150.00 TOTAL MONTHLY RECORD HOURS = 720.00

TABLE: F-113 OWMC AIR POLLUTION SURVEY

MET. DATA PRECIPITATION UNITS 0.01 m

STATION LINCOLN COUNTY MONTH MAY 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
12	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50.0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	475	0	0	0	475.0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	25.0
18	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100.0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	250	0	0	0	0	0	0	0	0	0	0	250.0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	350	350.0
MEAN	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0	0.0	8.1	0.0	0.8	0.0	0.0	0.0	0.0	15.3	0.0	0.0	11.3	1.7
																								TOTAL	1250

PERCENTAGE OF DATA VALID 100.0 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 1250.00 TOTAL MONTHLY RECORD HOURS = 744.00

TABLE F-114

Summary of Total Monthly Precipitation at OWMC Preferred Site (mm)
June 1986 to May 1987

Month	Site mm	Mt. Hope mm	Maximum Hourly at Site
1986			
June	75	77	11.25
July	85	99	11.75
August	91	86	16.00
September	91	126	15.00
October	49	74	3.75
November	49	66	3.75
December	55*	88	4.25
1987			
January	9*	57	1.00
February	11**	18	.75
March	70**	71	4.50
April	41**	91	3.00
May	13	36	4.75
Summer	251	262	16.00
Fall	189	266	15.00
Winter	75*	163	4.25
Spring	124	198	4.75
Annual	639*	889	16.00

Notes:

* Values are low due to inability to measure snowfall accurately with heated tipping bucket
**Recorded by Nipher Snow Gauge

TABLE F-115

OWMC Preferred Site
Estimated Mixing Layer Heights* (m above ground) and
the Associated Atmospheric Stability at the Surface
Spring, 1986

Date	Time (LST) 0100	0400	0700	1000	1300	1600	1900	2200
April								
1	NA	NA	0(S)	324(U)	162(U)	>2925(N)	315(N)	648(N)
2	0(S)	0(S)	0(S)	225(U)	891(U)	1620(U)	0(S)	0(S)
3	0(S)	0(S)	>2205(N)	486(U)	1215(U)	468(U)	162(U)	0(S)
4	0(S)	0(S)	90(N)	324(N)	810(N)	585(U)	0(S)	0(S)
5	0(S)	0(S)	162(N)	162(N)	NA	180(N)	0(S)	0(S)
6	0(S)	0(S)	0(S)	1350(N)	270(N)	NA	0(S)	0(S)
7	0(S)	0(S)	162(N)	2430(N)	1620(N)	324(N)	0(S)	608(N)
8	0(S)	1944(N)	1620(N)	2520(N)	2187(N)	>2997(N)	1863(N)	2430(N)
9	891(N)	>900(N)	2147(N)	1377(U)	2511(U)	1296(N)	>2160(N)	>2400(N)
10	>2160(N)	180(N)	1089(N)	932(U)	2754(U)	1917(N)	1620(N)	>2700(N)
11	>2700(N)	1134(N)	1710(N)	1935(N)	2790(U)	1296(N)	0(S)	>1980(N)
12	1553(N)	0(S)	180(U)	1080(N)	1782(N)	1620(U)	0(S)	0(S)
13	0(S)	0(S)	63(U)	486(U)	135(U)	2070(U)	0(S)	0(S)
14	0(S)	0(S)	117(U)	486(U)	972(U)	315(U)	0(S)	0(S)
15	0(S)	0(S)	NA	NA	NA	NA	NA	NA

Notes:
NA = not available
(S) = stable conditions at surface
(N) = neutral stability at surface
(U) = unstable conditions at surface

* Mixing heights is defined as the bottom of the inversion layer closest to the ground. Balloon rise rate of 2.7 m/s assumed.

TABLE F-116

OWMC Preferred Site
Estimated Mixing Layer Heights* (m above ground) and
Associated Atmospheric Stability at the Surface
Summer, 1986

Date	Time (LST) 0100	0400	0700	1000	1300	1600	1900	2200
July								
1	NA	NA	126(N)	1620(U)	2187(N)	2673(N)	81(N)	>2700(N)
2	0(S)	729(N)	1539(N)	243(U)	2268(U)	810(N)	122(N)	0(S)
3	567(N)	>1539(N)	2430(N)	2268(U)	2430(U)	1620(U)	1890(N)	0(S)
4	0(S)	0(S)	NA	2025(N)	567(U)	1620(N)	810(N)	0(S)
5	0(S)	243(N)	243(N)	243(N)	324(N)	450(N)	243(N)	NA
6	NA	NA	NA	NA	NA	NA	243(N)	0(S)
7	0(S)	0(S)	0(S)	270(U)	405(U)	486(N)	1620(N)	0(S)
8	0(S)	0(S)	0(S)	162(N)	2511(N)	270(N)	891(N)	0(S)
9	0(S)	0(S)	0(S)	243(N)	486(U)	>2916(U)	2187(U)	0(S)
10	0(S)	0(S)	NA	NA	NA	2511(U)	0(S)	0(S)
11	0(S)	0(S)	NA	NA	NA	NA	NA	NA
12	NA	NA	NA	NA	NA	NA	NA	NA
13	NA	NA	NA	NA	NA	NA	NA	NA
14	NA	NA	1053(N)	486(N)	1458(N)	1134(N)	2835(N)	0(S)
15	0(S)	0(S)	108(U)	324(U)	3038(U)	1499(U)	2106(N)	0(S)
16	0(S)	0(S)	203(N)	>2673(N)	>5184(N)	1701(U)	1863(U)	0(S)
17	0(S)	0(S)	41(N)	243(N)	324(U)	419(U)	891(N)	81(N)
18	0(S)	0(S)	81(N)	405(U)	1499(N)	NA	81(N)	41(N)
19	0(S)	162(N)	NA	NA	NA	NA	NA	NA

Notes:
NA - Not Available
(S) = stable conditions at surface
(N) = neutral conditions at surface
(U) = unstable conditions at surface
*Mixing height is defined as the bottom of the inversion layer closest to the ground. Balloon rise rate of 2.7 m/s assumed.

TABLE F-117

OWMC Preferred Site
Estimated Mixing Layer Heights* (m above ground) and
Associated Atmospheric Stability at the Surface
Fall, 1986

Date	Time (LST) 0100	0400	0700	1000	1300	1600	1900	2200
October								
6	NA	NA	>2700(N)	972(U)	1094(U)	1863(N)	1904(N)	0(S)
7	0(S)	0(S)	108(U)	81(U)	810(U)	899(N)	0(S)	0(S)
8	0(S)	0(S)	0(S)	810(N)	648(N)	1661(N)	0(S)	>2187(N)
9	365(N)	365(N)	729(N)	1053(N)	446(U)	1094(U)	1499(N)	0(S)
10	0(S)	1539(N)	1377(N)	1377(U)	1377(U)	1134(U)	0(S)	0(S)
11	0(S)	0(S)	486(N)	446(N)	1256(N)	1985(N)	0(S)	0(S)
12	0(S)	0(S)	0(S)	243(N)	284(N)	1418(N)	0(S)	0(S)
13	NA	NA	NA	NA	608(N)	NA	1701(N)	108(N)
14	162(N)	>5508(N)	1580(N)	1782(N)	3969(N)	2552(N)	0(S)	365(N)
15	>2835(N)	324(N)	243(N)	432(N)	2835(U)	2268(N)	2309(N)	2228(N)
16	2268(N)	0(S)	0(S)	527(N)	3564(U)	1620(N)	>5346(N)	0(S)
17	162(U)	0(S)	2349(U)	1013(U)	>5850(N)	3483(N)	2754(N)	0(S)
18	0(S)	0(S)	0(S)	1580(U)	1458(U)	1134(U)	0(S)	0(S)
19	0(S)	0(S)	0(S)	0(S)	1296(U)	891(N)	0(S)	0(S)
20	NA	0(S)	NA	NA	NA	NA	NA	NA

Notes:
NA = Not Available
(S) = stable conditions at surface
(N) = neutral stability at surface
(U) = unstable conditions at surface (turning to neutral with height in all cases)

* Mixing height is defined as the bottom of the stable "layer" closest to the ground. Rise rate of 2.7 m/s assumed.

TABLE F-118

OWMC Preferred Site
Estimated Mixing Layer Heights* (m above ground) and
Associated Atmospheric Stability at the Surface
Winter, 1986-87

Date	Time (LST) 0100	0400	0700	1000	1300	1600	1900	2200
January								
6	NA	NA	0(S)	0(S)	162(N)	0(S)	0(S)	0(S)
7	0(S)	0(S)	NA	NA	NA	NA	NA	NA
8	NA	NA	NA	NA	NA	NA	NA	NA
9	NA	NA	NA	NA	NA	NA	0(S)	1053(N)
10	360(N)	810(N)	932(N)	198(N)	324(N)	284(N)	2795(N)	0(S)
11	243(N)	1094(S)	>3078(N)	1134(N)	648(N)	1094(N)	810(N)	1053(N)
12	1377(N)	1458(N)	365(N)	261(N)	203(N)	1701(N)	1499(N)	1701(N)
13	0(S)	1458(N)	1701(N)	1256(N)	567(N)	648(N)	0(S)	0(S)
14	0(S)	0(S)	97(N)	486(N)	324(N)	243(N)	0(S)	324(N)
15	0(S)	302(N)	486(N)	567(N)	450(N)	450(N)	>1944(N)	1418(N)
16	1791(N)	1377(N)	1661(N)	1620(N)	1337(U)	1580(N)	1701(N)	0(S)
17	1580(N)	1701(N)	0(S)	1296(N)	1134(N)	1094(N)	810(N)	324(N)
18	243(N)	108(N)	1701(N)	1134(N)	729(N)	1134(N)	1053(N)	0(S)
19	0(S)	0(S)	1175(N)	1053(N)	891(N)	NA	NA	NA
20	NA	NA	0(S)	122(N)	1539(U)	1458(N)	2228(N)	NA

Notes:
NA = Not Available
(S) = stable conditions at surface
(N) = neutral stability at surface
(U) = unstable conditions at surface (turning to neutral with height in all cases)

* Mixing height is defined as the bottom of the stable "layer" closest to the ground. Rise rate of 2.7 m/s assumed.

TABLE: F-119

OWMC AIR POLLUTION SURVEY

SULPHUR DIOXIDE

UNITS PPB

STATION LINCOLN COUNTY

MONTH JUN 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	4	4	3	3	3	3	3	5	5	6	7	13	8	8	8	5	3	3	3	4	3	3	3	3	4.7
2	3	3	3	3	3	4	4	4	4	5	5	5	6	****	****	****	5	7	7	7	10	8	8	7	5.3
3	4	4	4	4	5	6	6	8	10	17	7	7	5	7	6	5	6	6	7	7	7	7	6	6	6.5
4	7	6	7	7	8	9	8	8	18	28	35	38	25	12	****	12	10	15	35	33	7	7	6	****	15.5
5	6	6	6	5	4	4	5	7	6	5	4	5	5	5	4	4	3	3	4	3	3	4	6	****	4.7
6	3	4	4	3	3	3	4	5	5	4	4	6	5	5	4	3	3	4	3	3	3	2	2	****	3.7
7	2	2	3	3	4	5	4	3	3	3	3	3	4	4	4	5	10	12	7	11	13	12	5	****	5.4
8	3	4	4	5	5	4	4	3	3	7	5	7	3	3	3	3	3	3	3	2	3	3	3	****	3.7
9	4	4	4	6	5	5	5	2	****	5	****	****	2	1	4	4	7	4	7	5	5	5	5	****	4.4
10	5	4	4	5	5	5	6	8	7	11	12	8	7	7	5	7	9	12	12	12	9	9	9	****	7.7
11	11	14	9	8	7	5	5	22	15	13	9	8	7	6	4	3	4	3	3	3	3	3	3	****	7.3
12	17	7	5	4	3	3	4	4	3	4	2	2	3	2	12	5	10	3	2	3	4	4	7	****	4.9
13	3	7	7	5	4	3	3	3	3	3	3	3	3	3	25	20	17	13	10	3	3	3	3	****	6.5
14	3	3	3	2	2	2	2	3	5	13	6	7	7	5	3	2	5	7	9	5	2	2	2	****	4.3
15	3	3	3	3	3	3	3	3	7	7	5	5	5	3	3	2	3	3	3	3	2	3	3	****	3.5
16	3	3	2	2	2	3	7	9	12	8	8	12	13	9	8	7	6	7	3	2	3	4	5	****	6.0
17	3	3	3	2	3	5	6	6	3	2	3	3	5	3	3	2	2	3	3	2	3	2	2	****	3.1
18	2	2	2	2	2	2	2	2	4	4	3	2	2	13	15	7	7	7	5	3	2	3	3	****	4.2
19	4	7	5	6	6	12	10	12	11	20	23	16	25	15	12	4	3	7	9	7	5	3	3	****	9.8
20	3	2	2	4	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	****	2.3
21	3	2	3	3	2	2	2	2	2	2	3	2	4	3	2	2	2	2	2	2	2	2	2	****	2.3
22	3	3	2	3	4	5	7	7	7	12	12	14	12	12	10	9	13	17	14	7	7	3	2	****	8.0
23	3	2	2	2	2	2	2	3	3	2	1	2	3	2	3	9	7	6	6	4	3	3	4	****	3.3
24	2	8	6	5	5	5	3	3	2	1	1	2	2	3	2	2	3	2	3	3	3	2	2	****	3.0
25	3	3	2	2	2	2	3	3	7	6	6	5	5	4	4	3	3	7	5	3	3	2	3	****	3.7
26	2	3	3	2	2	2	2	3	5	7	5	12	10	4	4	9	10	4	4	4	5	5	7	****	5.0
27	****	****	****	****	****	****	****	****	****	****	****	****	20	5	3	5	0	0	0	0	0	0	0	****	****
28	0	0	0	1	0	0	0	0	1	0	0	1	1	1	5	10	10	3	0	0	0	0	0	****	1.4
29	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	****	0.2
30	0	0	1	0	0	0	0	2	2	1	0	0	0	0	0	0	0	0	0	1	2	1	0	****	0.4
MEAN	3.8	3.9	3.5	3.4	3.3	3.7	3.9	4.9	5.5	6.8	6.2	6.8	6.6	5.1	5.7	5.2	5.5	5.5	5.7	4.8	3.9	3.6	3.5	****	4.8

PERCENTAGE OF DATA VALID 93.6

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 3252.00 TOTAL MONTHLY RECORD HOURS = 674.00

TABLE: F-120

OWMC AIR POLLUTION SURVEY

SULPHUR DIOXIDE

UNITS PPB

STATION LINCOLN COUNTY

MONTH JUL 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	1	0	0	1	1	2	2	1	0	1	1	0	****	0	1	2	2	1	2	6	****	1.1
2	2	3	2	0	0	0	0	0	0	2	2	6	7	5	2	2	0	1	1	1	1	1	3	****	1.8
3	4	1	1	1	1	2	2	3	2	2	1	1	0	1	1	1	0	0	0	2	1	0	1	****	1.2
4	0	0	0	0	0	0	0	0	1	1	22	12	10	7	3	15	2	2	2	2	2	1	1	****	3.6
5	6	7	6	9	8	7	6	7	7	9	10	11	13	10	17	17	18	11	10	11	10	12	16	****	10.3
6	6	6	3	3	3	3	2	5	12	17	18	27	29	17	36	18	14	9	19	10	6	6	7	****	12.0
7	5	3	4	5	5	3	3	3	4	4	4	4	9	6	5	4	4	5	5	4	3	4	6	****	4.4
8	0	0	0	0	0	0	0	0	2	7	10	7	2	7	4	12	24	35	53	26	4	3	3	****	8.7
9	1	0	0	0	0	1	1	1	1	0	0	6	0	0	0	5	2	1	2	0	0	1	0	****	1.0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
11	1	2	1	1	1	0	1	0	2	2	2	2	1	1	3	4	1	0	0	0	0	3	5	****	1.4
12	4	4	4	2	3	3	2	3	2	2	4	2	1	1	1	0	0	0	0	0	2	1	1	****	1.8
13	0	2	0	1	0	0	1	0	0	1	3	3	3	4	4	2	1	0	0	6	7	7	0	****	2.0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	1	1	0	0	0	0	****	0.3
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	18	28	6	2	0	0	0	****	2.9
16	1	1	1	2	1	1	0	3	3	6	12	5	6	8	5	4	2	16	42	35	10	0	3	****	7.3
17	0	0	0	0	0	0	0	0	1	1	3	2	1	1	3	2	2	10	13	13	28	11	2	****	4.0
18	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
19	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	2	1	1	****	0.3
20	1	1	1	1	1	2	1	1	2	1	2	1	2	1	1	1	1	1	1	1	1	1	1	****	1.2
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
22	1	1	2	1	2	2	2	2	3	3	7	7	3	4	10	****	7	5	7	8	6	5	5	****	4.2
23	3	1	0	0	0	0	0	1	1	17	34	21	13	9	8	5	4	2	1	1	1	1	0	****	5.3
24	0	1	0	0	0	0	0	0	7	0	0	7	7	11	10	6	1	1	1	5	9	5	2	****	3.2
25	1	1	0	0	0	3	6	11	13	14	26	17	18	19	18	20	63	29	8	4	3	2	5	****	12.2
26	4	4	4	3	3	1	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	1.1
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
28	0	0	0	0	0	0	0	0	0	1	1	4	2	1	0	1	0	0	1	0	0	0	0	****	0.5
29	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
30	0	0	0	0	0	0	1	0	1	1	2	1	0	0	1	1	1	2	0	0	0	0	0	****	0.5
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0	0	59	1	7	0	0	****	****	3.2
MEAN	1.3	1.3	0.9	1.0	0.9	0.9	1.0	1.4	2.2	3.0	5.3	4.7	4.1	3.7	4.4	4.6	5.4	7.1	5.7	4.5	3.1	2.2	2.3	****	3.1

PERCENTAGE OF DATA VALID 95.3

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 2186.00 TOTAL MONTHLY RECORD HOURS = 709.00

TABLE: F-121

OWMC AIR POLLUTION SURVEY

SULPHUR DIOXIDE

UNITS PPB

STATION LINCOLN COUNTY

MONTH AUG 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	1	1	2	3	2	3	4	3	3	3	****	****	1	1	2	3	2	1	1	1	2	2	1	****	2.0
2	0	1	1	2	1	1	2	1	3	5	3	2	1	2	3	2	4	10	11	3	3	1	2	****	2.8
3	0	0	0	1	2	2	2	2	4	2	1	1	0	1	1	3	1	1	4	0	0	0	1	****	1.3
4	1	1	1	0	0	0	0	0	5	5	1	0	0	7	7	2	1	2	2	1	1	0	0	****	1.6
5	0	0	0	0	0	0	0	1	4	5	12	1	0	8	9	3	3	2	1	5	7	6	3	****	3.0
6	0	0	0	0	0	0	0	0	0	0	10	10	5	10	5	2	5	6	4	2	1	1	2	****	2.7
7	1	2	1	0	0	0	0	0	0	5	10	5	5	10	15	10	15	5	5	5	5	0	0	****	4.3
8	0	0	0	0	0	0	0	0	0	0	0	0	0	21	7	21	14	22	6	1	0	0	0	****	4.0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
10	0	0	0	0	0	0	0	0	0	10	0	0	0	5	5	5	5	5	0	0	0	0	0	****	1.5
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	2	0	****	0.2
12	1	1	1	1	1	2	3	2	0	1	1	0	0	0	5	4	8	5	7	10	6	4	4	****	2.9
13	1	1	0	1	2	2	1	2	3	2	2	3	2	7	8	4	1	3	5	4	5	2	****	****	2.8
14	9	8	5	5	2	3	6	4	12	14	10	11	11	9	8	10	11	11	11	9	7	6	6	****	8.2
15	3	6	7	6	8	9	6	5	8	9	9	9	12	12	11	7	5	64	59	5	4	4	4	****	11.8
16	5	3	3	4	3	2	2	3	4	4	3	3	2	4	4	10	8	4	3	5	3	2	2	****	3.7
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
18	2	3	1	1	0	0	0	0	0	0	1	0	0	0	0	****	****	****	****	****	11	11	11	****	2.3
19	0	2	1	1	1	1	1	1	1	3	3	2	2	1	1	2	4	3	3	4	3	3	3	****	2.0
20	8	7	7	7	9	9	7	13	10	5	6	3	3	4	4	3	3	2	2	2	3	3	1	****	5.3
21	2	7	7	7	8	7	7	7	9	12	10	13	21	14	15	17	12	7	7	7	6	7	7	****	9.4
22	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2	1	1	1	1	1	2	****	0.5
23	15	6	4	3	2	0	0	5	20	17	8	22	13	7	2	7	4	4	10	3	****	****	****	****	7.6
24											DATA MISSING														
25	****	****	****	****	****	****	****	****	****	****	6	5	90	10	9	9	9	5	3	5	0	6	5	****	12.5
26	5	3	3	3	0	3	7	6	7	15	17	23	23	24	27	30	18	14	13	7	5	7	16	****	12.0
27	13	10	10	8	6	3	3	3	3	3	3	2	2	3	3	3	1	2	5	5	7	11	8	****	5.1
28	3	3	5	6	7	5	4	6	12	8	3	3	2	1	2	2	2	2	2	3	3	0	2	****	3.7
29	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2	1	1	1	1	1	2	****	0.5
30	0	0	1	1	0	0	0	0	1	2	6	10	17	15	10	7	9	8	5	3	3	1	1	****	4.3
31	0	0	0	0	0	0	0	0	1	2	1	1	3	5	4	4	4	3	4	2	3	5	5	****	2.0
MEAN	2.5	2.2	2.1	2.1	1.9	1.8	1.9	2.2	3.8	4.6	4.4	4.4	7.2	6.0	5.6	5.9	5.3	6.7	6.1	3.3	3.1	3.0	3.3	****	3.9

PERCENTAGE OF DATA VALID 89.8

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 2598.00 TOTAL MONTHLY RECORD HOURS = 668.00

TABLE: F-122

OWMC AIR POLLUTION SURVEY

SULPHUR DIOXIDE

UNITS PPB

STATION LINCOLN COUNTY

MONTH SEP 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	9	7	2	1	1	1	1	1	1	3	6	5	3	2	1	1	1	4	3	2	1	1	1	****	2.5
2	1	1	0	0	0	0	0	0	0	0	0	1	1	1	1	2	3	4	4	3	1	2	5	****	1.3
3	6	7	9	10	6	4	4	3	4	5	4	3	2	1	1	1	3	4	3	1	1	2	0	****	3.7
4	1	3	5	4	5	7	4	5	7	8	7	8	11	8	6	6	5	6	6	6	5	5	6	****	5.8
5	9	4	3	2	2	1	1	1	1	1	1	1	1	0	1	4	12	13	7	5	3	2	****	****	3.4
6											DATA MISSING														
7											DATA MISSING														
8											DATA MISSING														
9	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	3	3	3	****	****
10	0	1	2	3	4	7	9	12	10	21	23	12	8	23	28	28	35	16	9	7	3	3	3	****	11.6
11	10	8	7	5	4	4	3	1	1	2	2	2	2	2	2	2	3	2	1	1	1	3	3	****	3.1
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
13	0	0	1	0	0	1	0	0	1	1	1	2	2	2	2	1	0	0	0	0	0	0	0	****	0.6
14	0	1	0	1	0	0	0	0	5	5	4	2	1	0	0	2	5	2	1	0	0	0	1	****	1.3
15	0	0	0	0	0	0	0	0	0	0	1	0	0	2	25	9	3	3	2	1	1	1	0	****	2.1
16	1	1	3	3	1	1	0	2	2	2	2	1	1	1	0	1	1	1	0	0	1	1	1	****	1.2
17	0	3	3	3	3	0	0	0	0	5	10	5	3	3	3	8	8	3	3	3	3	5	8	****	3.6
18	5	13	18	10	8	5	8	18	13	10	30	45	18	15	15	15	13	8	8	7	5	4	4	****	12.8
19	1	0	2	8	9	8	6	5	5	5	6	6	9	12	20	31	25	16	9	5	7	5	3	****	8.8
20	4	3	2	7	1	2	3	2	1	1	2	2	1	1	1	1	0	0	0	0	1	0	0	****	1.5
21	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	2	1	0	0	1	1	****	0.4
22	2	2	5	3	3	3	3	3	2	2	1	1	1	1	1	2	14	9	6	5	3	4	2	****	3.4
23	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0	2	3	2	1	1	1	1	1	****	0.8
24	0	0	0	0	0	0	0	0	0	1	1	1	1	3	10	6	12	4	5	2	1	1	0	****	2.1
25	0	0	1	0	0	1	0	1	2	2	3	4	4	6	5	5	4	4	6	4	2	2	3	****	2.6
26	3	5	5	3	3	0	0	0	0	3	3	3	3	3	3	0	0	0	3	0	0	0	0	****	1.7
27	0	0	3	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0	****	0.4
28	0	3	0	0	0	0	0	0	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
29	0	0	0	5	10	13	0	0	0	0	0	0	[illegible]	0	0	15	20	10	3	3	3	3	8	****	4.2
30	10	8	5	3	5	5	3	3	3	3	3	8	10	8	5	3	0	0	0	0	3	5	3	****	4.2
MEAN	2.4	2.8	3.0	2.7	2.5	2.5	1.7	2.2	2.3	3.2	4.4	4.5	3.5	3.9	5.2	5.8	6.8	4.5	3.2	2.2	1.9	2.1	2.2	****	3.3

PERCENTAGE OF DATA VALID 81.3

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 1918.00 TOTAL MONTHLY RECORD HOURS = 585.00

TABLE: F-123

OWMC AIR POLLUTION SURVEY

SULPHUR DIOXIDE

UNITS PPB

STATION LINCOLN COUNTY

MONTH OCT 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	****	0.0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	****	****	0	0	0	0	0	****	0.0
3	0	1	3	0	0	0	0	0	0	2	5	3	1	1	1	1	1	1	0	0	0	0	0	****	0.9
4	0	0	0	0	3	5	9	6	4	1	1	2	0	0	0	0	0	0	0	1	0	0	0	****	1.4
5	****	0	0	0	1	0	1	1	1	1	1	0	0	0	0	3	2	2	8	10	17	13	0	****	2.8
6	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	****	****	0	0	0	0	0	0	****	0.0
7	0	0	0	0	0	0	0	1	1	2	9	47	35	13	7	4	2	1	1	1	6	7	4	****	6.1
8	5	4	4	10	23	16	12	15	16	16	17	15	16	18	15	19	19	15	9	7	8	6	5	****	12.6
9	5	12	5	2	3	1	0	0	0	0	0	0	0	0	0	1	0	1	4	2	0	0	1	****	1.6
10	0	0	0	0	1	0	2	1	1	2	3	2	2	1	1	1	2	2	1	1	2	8	15	****	2.1
11	8	4	3	2	2	4	4	3	10	23	26	11	7	6	13	16	5	5	5	4	3	15	22	****	8.7
12	7	6	6	6	5	5	10	16	9	9	22	17	10	18	19	11	11	7	6	6	6	10	9	****	10.0
13	3	3	4	5	4	5	3	3	3	3	3	2	0	0	0	1	3	5	6	3	1	0	0	****	2.6
14	7	6	4	4	7	3	4	7	6	4	1	2	2	2	3	13	6	1	1	3	1	1	1	****	3.9
15	1	1	2	2	1	1	1	1	1	****	****	0	0	0	0	0	0	0	0	0	0	0	0	****	0.5
16	0	0	0	0	0	0	1	2	****	****	****	****	0	0	0	0	0	1	0	0	0	0	0	****	0.2
17	0	0	0	1	2	3	5	8	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	****	1.1
18	0	1	0	0	0	0	1	1	1	2	2	1	1	1	1	1	1	1	1	1	0	1	****	****	0.8
19	DATA MISSING																								
20	****	****	****	****	****	****	****	****	****	****	****	****	****	****	11	10	4	5	5	3	4	8	8	****	****
21	8	5	1	1	4	4	3	3	4	10	12	8	7	6	6	4	3	4	4	4	2	0	0	****	4.5
22	0	0	0	0	0	0	0	0	0	1	1	8	12	11	10	7	6	6	6	6	3	4	5	****	3.7
23	4	5	5	4	4	5	5	5	5	4	4	3	2	1	1	2	1	2	2	3	3	3	3	****	3.3
24	0	0	0	0	0	2	2	2	1	4	1	0	0	0	0	0	0	0	0	0	2	5	4	****	1.0
25	4	5	11	7	1	8	5	2	3	2	3	4	5	6	8	11	9	6	2	2	3	4	5	****	5.0
26	4	3	3	5	2	1	1	0	2	6	4	5	7	7	4	2	1	1	1	2	2	2	3	****	3.0
27	3	2	2	1	1	2	1	1	2	7	10	7	6	3	7	8	4	3	2	0	0	0	0	****	3.1
28	0	0	0	0	0	0	0	0	0	1	0	0	1	10	13	13	5	4	2	3	4	4	3	****	2.7
29	8	10	12	11	11	11	10	10	12	12	14	14	14	10	12	5	7	4	3	0	1	2	3	****	8.5
30	6	6	2	1	1	1	1	1	1	1	4	8	8	13	12	12	10	9	7	6	4	3	3	****	5.2
31	2	4	8	8	12	8	5	5	5	5	3	3	4	4	10	4	2	2	4	5	4	6	7	****	5.2
MEAN	2.7	2.7	2.6	2.4	3.0	2.9	3.0	3.2	3.3	4.4	5.4	5.8	4.8	4.7	5.3	5.2	3.7	3.0	2.7	2.4	2.5	3.4	3.5	****	3.6

PERCENTAGE OF DATA VALID 89.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 2371.00 TOTAL MONTHLY RECORD HOURS = 662.00

TABLE: F-124

OWMC AIR POLLUTION SURVEY

SULPHUR DIOXIDE

UNITS PPB

STATION LINCOLN COUNTY

MONTH NOV 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	8	8	8	9	11	12	15	16	15	16	17	15	14	14	15	14	13	10	4	0	0	0	0	****	10.2
2	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	1	1	2	3	3	****	0.7
3	1	2	1	1	1	1	2	2	2	6	7	11	14	9	8	7	11	3	6	16	10	2	2	****	5.4
4	3	4	4	4	3	1	1	1	1	1	2	4	3	7	6	8	5	2	1	1	1	1	0	****	2.8
5	2	4	6	3	4	2	1	2	7	****	****	4	4	3	4	4	3	2	1	4	****	****	****	****	3.3
6											DATA MISSING														
7	****	****	****	****	****	****	****	****	****	****	****	****	14	8	10	11	12	14	17	15	14	7	4	****	****
8	4	6	7	6	6	6	8	5	3	5	13	4	6	7	6	5	3	3	6	2	1	1	2	****	5.0
9	3	1	1	2	1	1	2	4	6	7	5	5	7	5	4	1	0	0	1	0	0	1	1	****	2.5
10	1	1	1	1	1	3	5	2	1	2	1	1	1	1	0	0	1	9	9	8	7	6	7	****	3.0
11	8	6	6	5	4	3	2	2	2	2	2	1	2	2	2	2	1	0	0	0	0	0	0	****	2.3
12	0	0	0	0	0	0	2	2	5	65	37	14	44	18	6	****	25	10	11	11	11	10	10	****	12.8
13	6	7	7	6	6	6	6	7	8	10	6	10	7	7	7	6	7	7	7	7	7	7	7	****	7.0
14	7	7	7	6	7	8	9	10	11	12	13	25	11	10	10	8	9	10	15	15	13	13	25	****	11.3
15	25	28	25	14	9	8	9	10	12	14	13	22	66	20	17	15	16	17	15	14	13	13	9	****	17.6
16	8	10	14	14	13	10	10	10	9	9	10	11	11	10	9	9	9	9	9	10	10	8	2	****	9.7
17	6	7	7	7	7	9	10	11	30	12	16	19	23	20	14	20	11	9	8	6	5	5	4	****	11.6
18	0	3	4	3	4	4	6	10	6	5	6	6	6	7	9	6	6	7	6	6	6	6	4	****	5.5
19	6	3	3	4	4	3	5	10	7	6	6	6	6	6	****	****	2	2	2	4	7	13	16	****	5.8
20	7	7	11	15	13	16	16	10	5	6	7	9	11	10	7	7	****	****	9	11	9	5	4	****	9.3
21	11	5	3	6	0	0	1	2	3	3	3	5	4	3	6	6	5	6	6	5	3	4	4	****	4.1
22	2	2	1	0	0	0	0	0	0	2	5	6	9	8	8	7	4	3	8	15	21	18	4	****	5.3
23	7	9	7	11	12	15	13	13	14	14	15	15	17	15	11	11	13	12	9	8	8	7	7	****	11.4
24	6	4	3	3	2	3	4	4	3	2	1	1	1	1	1	1	2	2	4	2	1	3	7	****	2.7
25	4	3	1	1	4	5	4	5	6	9	8	11	7	20	19	11	9	9	9	9	8	7	6	****	7.6
26	6	16	21	19	15	12	6	3	3	5	5	3	3	2	2	2	6	8	10	12	10	4	2	****	7.6
27	2	3	3	2	2	2	2	0	0	1	4	5	6	2	3	25	12	1	1	2	4	4	3	****	3.9
28	5	14	0	1	2	2	5	15	38	42	4	3	4	12	20	10	4	5	3	5	5	6	6	****	9.2
29	8	3	2	3	3	3	3	3	2	3	3	3	2	2	1	1	1	1	0	0	1	9	5	****	2.7
30	1	0	3	5	3	4	2	0	0	0	1	0	0	0	0	1	0	1	2	2	2	2	3	****	1.4
MEAN	5.3	5.8	5.6	5.4	4.9	5.0	5.3	5.7	7.1	9.6	7.8	7.9	10.5	7.9	7.3	7.3	6.8	5.8	6.2	6.6	6.4	5.9	5.3	****	6.6

PERCENTAGE OF DATA VALID 89.6

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 4243.00 TOTAL MONTHLY RECORD HOURS = 645.00

TABLE: F-125

OWMC AIR POLLUTION SURVEY

SULPHUR DIOXIDE

UNITS PPB

STATION LINCOLN COUNTY

MONTH DEC 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	3	2	3	2	2	3	3	4	4	4	5	4	0	3	2	4	3	2	3	3	5	7	9	****	3.5
2	8	3	0	0	0	0	5	1	0	0	0	0	0	0	0	0	2	4	0	0	0	0	0	****	1.0
3	****	****	****	****	****	****	****	****	****	****	2	7	12	9	5	3	3	3	1	2	3	3	2	****	4.2
4	1	1	2	1	1	1	2	2	1	2	2	2	2	2	2	1	1	1	3	7	10	11	9	****	2.9
5	1	1	1	2	2	2	3	3	3	2	2	2	2	****	1	1	0	0	0	1	1	2	3	****	1.6
6	4	2	1	2	6	6	7	14	14	14	18	15	9	9	10	11	11	11	10	10	8	8	6	****	9.0
7	1	0	1	2	3	6	7	7	9	12	16	15	17	11	7	14	5	6	5	6	6	5	4	****	7.2
8	3	2	2	2	1	1	1	1	2	1	2	2	3	3	4	5	5	****	4	5	10	10	8	****	3.5
9	6	7	9	9	10	9	9	9	11	13	12	7	4	4	4	4	4	11	25	12	7	7	8	****	8.7
10	6	6	7	8	7	6	3	3	3	3	3	6	7	10	12	7	****	****	2	2	2	3	3	****	5.2
11	11	10	8	10	12	11	10	9	11	8	5	5	3	5	3	4	12	17	18	19	19	23	22	****	11.1
12	38	20	7	5	4	4	5	4	3	2	1	1	1	1	1	1	1	1	0	1	1	2	2	****	4.6
13	2	10	8	10	8	11	10	7	5	8	13	6	3	2	1	1	1	0	1	2	3	1	2	****	5.0
14	10	4	7	6	8	11	12	24	16	25	29	20	12	10	9	28	6	7	7	7	5	7	7	****	12.0
15	8	7	5	5	4	4	4	5	4	4	4	5	40	7	5	9	6	4	3	3	3	3	4	****	6.3
16	6	6	9	12	13	12	13	13	11	16	16	16	15	13	11	11	9	7	9	12	15	14	12	****	11.8
17	12	13	12	11	11	13	17	13	11	12	13	15	22	28	25	13	9	9	9	8	6	7	9	****	13.0
18	14	13	13	13	12	12	11	12	9	12	14	16	8	4	5	5	5	4	3	2	2	3	4	****	8.5
19	6	4	3	2	2	2	1	2	2	2	2	2	2	1	2	1	1	2	2	1	1	1	1	****	2.0
20	1	1	1	1	1	0	1	1	1	1	2	2	2	1	2	2	2	2	5	4	2	1	2	****	1.7
21	5	3	3	4	5	4	4	4	13	6	4	3	2	4	6	1	1	1	1	1	1	1	1	****	3.4
22	2	2	2	2	3	3	4	4	4	****	****	****	****	16	14	3	2	2	5	9	12	14	8	****	5.8
23	6	7	8	17	8	6	6	7	6	6	6	7	7	13	19	18	17	13	12	10	8	7	6	****	9.6
24	5	8	9	6	5	16	13	5	5	6	9	12	11	6	5	3	3	4	4	3	2	****	****	****	6.7
25	3	3	3	2	2	1	1	1	2	3	1	1	0	0	0	0	0	1	1	1	1	1	2	****	1.3
26	1	1	1	1	2	2	1	1	1	0	1	1	1	2	2	3	3	2	2	2	2	2	2	****	1.6
27	3	2	2	2	1	1	1	1	1	1	1	2	3	3	4	5	3	4	3	3	2	2	1	****	2.2
28	3	4	4	4	3	3	2	2	3	8	9	6	5	4	6	23	28	16	11	19	22	15	13	****	9.3
29	7	7	7	7	10	11	11	10	7	8	13	12	12	12	11	11	11	8	8	7	8	7	8	****	9.3
30	11	11	11	11	19	17	13	15	16	11	9	6	5	9	10	6	4	4	4	6	7	4	2	****	9.2
31	3	2	2	2	2	3	2	2	2	2	2	3	8	7	4	5	9	9	8	6	9	15	13	****	5.2
MEAN	6.3	5.4	5.0	5.4	5.6	6.0	6.1	6.2	6.0	6.6	7.2	6.7	7.3	6.6	6.2	6.5	5.6	5.3	5.5	5.6	5.9	6.2	5.8	****	6.0

PERCENTAGE OF DATA VALID 93.1

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 4188.00 TOTAL MONTHLY RECORD HOURS = 693.00

TABLE: F-126 OWMC AIR POLLUTION SURVEY

SULPHUR DIOXIDE UNITS PPB

STATION LINCOLN COUNTY MONTH JAN 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	8	5	7	8	5	6	14	6	6	5	6	5	5	6	5	4	4	3	3	3	6	6	4	****	5.7
2	6	8	5	4	4	3	2	2	2	2	2	2	2	2	2	2	4	5	5	4	4	3	2	****	3.3
3	8	4	2	1	1	4	6	1	1	2	4	3	3	3	2	1	1	2	1	1	1	1	1	****	2.3
4	0	0	1	1	1	2	2	2	2	2	3	4	7	7	5	4	5	5	5	4	2	3	4	****	3.1
5	2	3	3	2	1	1	2	2	2	2	2	3	3	3	3	4	3	2	1	0	0	0	1	****	2.0
6	2	3	2	1	2	1	2	1	1	3	5	16	25	24	34	38	30	53	36	19	19	28	24	****	16.0
7	20	12	10	6	5	4	5	7	9	10	24	35	28	15	8	11	4	3	2	2	2	2	2	****	9.8
8	1	2	2	3	3	4	3	1	1	1	1	1	1	4	5	5	4	2	2	****	****	****	****	****	2.4
9	****	****	****	****	****	****	****	****	****	****	****	****	3	5	12	4	3	3	2	2	3	9	****	****	****
10	10	10	7	10	12	11	11	11	12	14	13	12	12	16	9	6	7	8	8	9	13	14	****	****	10.7
11	12	12	8	7	6	6	7	4	3	4	3	2	3	4	1	0	0	1	4	4	2	1	****	****	4.3
12	3	3	4	4	6	6	7	7	6	6	4	3	2	2	2	2	0	1	2	1	2	1	****	****	3.4
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	3	1	1	1	****	****	0.7
14	5	6	9	17	27	25	23	29	16	18	24	13	13	19	30	9	9	12	12	63	37	9	****	****	19.3
15	7	8	8	7	12	8	7	5	8	5	6	6	6	2	0	0	0	1	1	1	2	2	****	****	4.6
16	1	0	1	2	0	1	2	2	4	8	7	5	5	5	5	5	6	6	6	6	2	2	5	****	3.7
17	2	3	4	4	4	5	6	5	2	2	29	8	18	14	7	5	5	6	5	5	11	14	19	****	8.0
18	15	14	11	8	6	5	9	10	10	12	11	13	17	14	12	10	8	6	7	9	7	6	5	****	9.8
19	5	4	5	4	4	3	4	5	4	3	6	5	7	3	4	5	12	10	5	3	2	2	2	****	4.7
20	2	14	9	5	6	8	8	3	2	2	3	6	7	7	24	10	2	3	3	3	4	7	11	****	6.5
21	6	5	5	4	5	6	4	7	10	11	8	7	5	8	23	8	10	21	7	2	7	5	5	****	7.8
22	4	3	4	9	11	4	4	5	9	12	15	15	15	15	14	15	17	12	11	10	9	8	7	****	9.9
23	7	15	17	19	11	3	2	2	2	1	1	1	1	1	1	1	0	1	2	2	2	3	4	****	4.3
24	6	3	4	5	2	4	5	4	4	4	2	2	2	1	1	2	6	12	8	1	2	3	10	****	4.0
25	15	6	5	5	5	3	5	6	4	7	6	2	2	2	1	2	3	2	1	1	1	1	1	****	3.7
26	6	6	4	4	3	2	2	2	3	4	4	3	2	2	3	3	2	2	1	3	8	9	3	****	3.5
27	4	3	3	4	4	5	3	2	3	3	****	6	12	23	34	11	9	17	15	16	15	19	17	****	10.4
28	18	23	37	41	41	38	29	40	27	27	24	18	17	27	27	26	26	23	21	30	26	22	14	****	27.0
29	4	2	1	1	0	0	1	1	1	1	2	2	3	2	6	8	9	6	5	9	9	8	11	****	4.0
30	9	9	11	9	8	8	8	9	10	8	5	3	4	5	8	9	10	25	15	11	9	5	5	****	8.8
31	5	6	8	10	10	21	14	6	5	11	12	13	11	7	12	16	16	9	7	8	5	5	4	****	9.6
MEAN	6.4	6.4	6.6	6.8	6.8	6.6	6.6	6.2	5.6	6.3	8.0	7.1	7.8	8.0	9.7	7.3	7.1	8.6	6.6	7.8	7.1	6.6	7.0	****	7.1

PERCENTAGE OF DATA VALID 92.6 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 4892.00 TOTAL MONTHLY RECORD HOURS = 689.00

TABLE: F-127

OWMC AIR POLLUTION SURVEY

SULPHUR DIOXIDE

UNITS PPB

STATION LINCOLN COUNTY

MONTH FEB 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	2	1	1	1	1	3	4	4	6	5	12	10	8	13	11	9	13	16	15	11	10	18	9	****	8.0
2	10	8	8	10	15	23	10	10	11	12	9	10	7	9	9	7	4	3	4	8	3	3	2	****	8.5
3	1	20	25	13	10	6	5	6	6	3	3	2	2	3	3	3	2	2	2	2	2	2	2	****	5.4
4	1	1	1	****	****	****	****	****	****	****	****	****	****	****	****	****	1	3	2	1	3	2	1	****	****
5	1	2	2	3	2	2	1	0	0	1	2	1	40	18	17	38	3	1	6	12	17	22	12	****	8.8
6	6	7	5	4	3	3	4	6	7	6	7	8	13	13	6	7	7	40	21	17	13	7	5	****	9.3
7	4	2	2	2	2	2	1	1	0	0	0	1	0	0	0	0	0	1	1	0	0	0	2	****	0.9
8	6	5	5	2	3	4	9	8	5	3	1	1	0	0	0	0	0	2	3	3	6	7	****	****	3.3
9	7	4	6	4	4	6	8	8	12	39	47	23	2	6	2	1	1	2	6	8	15	18	****	****	10.4
10	42	45	27	6	6	6	6	6	****	****	6	4	3	2	1	3	7	11	11	10	6	6	****	****	10.7
11	5	4	2	1	1	1	1	1	0	1	2	4	2	3	3	3	3	3	2	2	1	1	****	****	2.1
12	2	8	17	15	7	19	15	11	11	10	7	10	4	2	****	1	13	17	11	5	7	3	****	****	9.3
13	4	13	12	19	14	8	7	10	9	6	7	7	5	5	6	7	7	5	5	5	5	4	****	****	7.7
14	5	6	6	4	2	2	5	6	4	3	7	7	8	3	1	1	1	1	1	1	1	1	****	****	3.5
15	1	1	0	0	0	0	1	1	1	1	1	1	8	6	2	1	5	3	3	3	2	8	****	****	2.2
16	1	1	0	1	0	3	1	2	2	7	2	1	1	0	0	1	****	****	2	2	1	2	14	****	2.1
17	3	4	4	5	7	11	8	4	8	3	1	0	0	0	0	0	0	0	1	2	7	7	6	****	3.5
18	5	6	4	9	4	3	2	2	2	2	0	0	0	0	0	0	3	15	10	4	3	3	4	****	3.5
19	2	3	2	2	2	1	2	2	3	11	11	7	11	18	17	10	2	1	1	2	3	12	12	****	6.0
20	9	7	9	8	4	2	1	1	1	2	3	2	3	4	2	1	2	3	6	4	2	1	0	****	3.3
21	0	0	0	0	0	1	1	1	0	2	2	3	8	6	3	1	0	7	10	11	18	17	14	****	4.6
22	9	8	9	11	10	7	6	7	11	11	9	6	6	7	8	8	7	3	0	1	2	3	2	****	6.6
23	1	1	3	4	4	4	4	5	9	21	13	15	17	13	3	****	****	2	2	2	2	3	3	****	6.2
24	4	4	5	4	2	1	1	2	6	4	2	1	0	0	4	4	3	3	6	12	14	10	3	****	4.1
25	1	0	0	0	0	0	0	1	7	5	2	1	1	9	8	2	0	1	0	0	0	0	0	****	1.7
26	3	7	2	1	1	2	1	3	5	3	3	2	1	1	0	5	1	1	1	1	1	2	1	****	2.1
27	3	3	2	3	3	6	13	12	8	4	9	14	10	4	4	3	3	3	3	4	5	4	4	****	5.5
28	5	4	4	5	5	5	7	3	1	0	2	2	2	2	2	3	3	3	4	3	3	5	****	****	3.3
MEAN	5.1	6.3	5.8	5.1	4.1	4.9	4.6	4.6	5.2	6.3	6.3	5.3	6.0	5.4	4.3	4.6	3.5	5.6	5.0	4.9	5.4	6.1	5.1	****	5.2

PERCENTAGE OF DATA VALID 91.5

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 3198.00 TOTAL MONTHLY RECORD HOURS = 615.00

TABLE: F-128

OWMC AIR POLLUTION SURVEY

SULPHUR DIOXIDE

UNITS PPB

STATION LINCOLN COUNTY

MONTH MAR 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	4	5	4	2	2	3	4	4	3	4	2	1	1	0	0	0	1	5	7	15	9	7	6	****	3.9
2	4	7	5	5	4	4	3	4	2	1	1	0	0	0	0	0	1	1	1	1	0	0	0	****	1.9
3	1	0	0	0	0	1	1	0	0	1	****	****	****	****	****	****	****	****	0	2	1	2	1	****	0.7
4	2	4	5	5	4	7	6	5	5	4	3	2	2	2	4	2	1	2	2	4	4	4	3	****	3.6
5	3	3	3	2	2	2	2	3	5	7	7	8	6	5	5	6	7	6	6	4	4	5	5	****	4.6
6	3	2	3	3	2	3	4	5	8	15	28	40	42	45	47	70	57	35	27	22	14	13	10	****	21.7
7	9	10	9	15	11	9	7	6	7	8	8	6	4	2	****	****	****	****	****	****	****	****	****	****	7.9
8	****	****	****	****	****	0	0	0	1	1	4	3	****	****	****	****	****	****	****	****	****	****	****	****	****
9	****	****	****	****	2	5	2	0	0	0	1	1	0	1	1	1	1	1	2	2	2	2	2	****	1.4
10	2	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	3	3	2	3	****	1.4
11	8	13	13	21	29	26	15	11	21	7	3	3	4	4	3	3	4	5	5	4	4	5	5	****	9.4
12	4	4	4	5	7	8	9	6	7	7	8	9	13	9	5	4	4	3	2	2	2	2	2	****	5.5
13	2	3	4	4	3	5	5	4	4	6	2	2	2	1	1	1	1	1	1	1	1	1	1	****	2.4
14	2	2	1	1	2	2	3	5	8	5	6	6	6	7	5	5	4	3	4	4	4	4	4	****	4.0
15	4	3	3	3	4	5	5	4	4	4	3	2	2	2	1	1	1	1	1	2	4	4	5	****	3.0
16	5	5	6	10	7	3	3	5	3	2	1	2	1	1	1	0	3	13	10	2	2	2	2	****	3.9
17	9	17	15	17	19	20	14	19	19	11	7	8	****	4	7	2	3	7	4	12	8	8	5	****	10.7
18	10	10	10	5	4	4	5	5	5	3	2	2	****	1	1	1	1	1	1	1	1	8	10	****	4.1
19	4	7	5	5	2	1	1	1	1	****	0	0	0	0	0	0	0	0	0	1	6	5	4	****	2.0
20	1	1	2	4	5	7	8	7	11	12	5	4	3	2	2	6	4	3	3	2	2	2	2	****	4.3
21	2	2	1	1	2	2	2	2	2	2	3	3	2	3	3	2	3	3	2	2	2	2	2	****	2.2
22	2	2	2	4	5	4	3	3	2	2	3	2	2	2	2	2	2	1	2	2	2	2	3	****	2.4
23	1	0	0	0	1	1	1	2	10	17	7	3	11	8	10	2	1	4	1	1	2	3	12	****	4.3
24	10	8	8	6	5	3	2	6	7	8	10	2	1	9	7	10	9	7	3	0	1	13	12	****	6.4
25	3	2	2	2	2	10	7	3	7	6	7	5	7	9	7	7	4	4	5	1	1	1	9	****	4.8
26	8	6	2	3	3	3	3	3	4	3	13	20	30	3	2	3	6	3	2	2	2	2	3	****	5.6
27	2	1	2	1	1	1	0	0	0	0	3	5	7	5	4	4	4	3	3	6	6	5	8	****	3.1
28	7	7	5	4	5	3	3	3	5	9	12	7	7	3	4	6	3	3	2	2	2	2	1	****	4.6
29	0	0	0	0	0	0	1	2	5	11	24	20	6	6	6	4	3	2	2	3	5	3	7	****	4.8
30	4	3	3	3	2	1	1	2	2	2	2	2	5	4	1	0	0	2	16	14	14	2	2	****	3.8
31	1	1	2	1	2	2	2	2	2	2	3	9	4	2	3	2	2	1	1	1	1	1	2	****	2.1
MEAN	4.0	4.4	4.2	4.6	4.6	4.7	4.0	4.0	5.2	5.4	6.0	5.9	6.3	4.9	4.8	5.2	4.7	4.3	4.0	4.1	3.8	3.9	4.5	****	4.7

PERCENTAGE OF DATA VALID 90.5

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 3136.00 TOTAL MONTHLY RECORD HOURS = 673.00

TABLE: F-129

OWMC AIR POLLUTION SURVEY

SULPHUR DIOXIDE

UNITS PPB

STATION LINCOLN COUNTY

MONTH APR 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	1	1	1	1	1	2	1	2	2	2	5	6	3	3	6	3	2	3	4	5	7	8	8	****	3.3
2	10	7	8	8	5	2	4	2	4	2	2	2	****	****	4	3	4	3	3	3	5	4	3	****	4.2
3	1	2	2	3	3	4	4	4	3	2	2	1	1	1	1	2	2	2	1	2	7	4	2	****	2.4
4	5	2	2	2	2	2	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.9
5	0	0	0	0	1	1	1	1	2	3	3	2	2	2	3	2	2	1	1	1	1	1	0	0	1.3
6	****	0	1	0	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	0.9
7	****	1	2	2	3	5	4	6	5	4	8	4	9	7	10	7	8	4	5	3	2	2	2	2	4.6
8	****	2	2	3	2	2	2	3	4	4	4	6	10	8	5	****	0	6	9	4	3	4	3	****	4.1
9	1	1	2	4	3	3	1	1	5	9	6	5	4	3	7	10	6	4	3	2	2	2	3	****	3.8
10	3	2	1	1	2	1	1	3	8	9	9	8	5	4	4	6	8	9	9	5	3	3	5	****	4.7
11	6	3	1	1	3	2	2	3	2	2	2	6	13	9	7	14	10	7	2	3	4	8	1	****	4.8
12	1	3	2	2	1	3	2	4	6	5	6	6	7	5	4	3	2	5	6	4	2	1	1	****	3.5
13	1	1	1	1	2	2	6	5	****	****	****	****	****	****	0	0	0	0	0	0	0	0	0	****	1.1
14	6	10	8	4	2	0	0	0	2	0	0	0	2	4	2	2	2	0	0	2	0	4	4	****	2.3
15	4	4	6	4	2	0	2	0	2	2	2	2	2	2	0	0	0	0	1	0	0	0	0	****	1.5
16	0	0	0	0	0	0	0	0	0	0	0	4	2	2	2	2	5	5	1	1	1	2	3	****	1.3
17	1	2	2	5	8	10	7	3	3	2	2	2	2	3	3	2	2	2	1	1	1	1	1	****	2.9
18	1	1	1	1	1	1	1	0	0	3	3	4	2	3	2	2	3	3	3	2	1	1	3	****	1.8
19	2	2	2	2	2	2	1	1	2	6	10	9	11	5	2	1	1	0	0	1	1	0	1	****	2.8
20	1	1	1	1	1	0	2	1	4	8	4	4	2	1	1	1	5	2	0	1	2	5	7	****	2.4
21	13	6	3	3	4	5	5	5	5	****	****	6	7	4	2	11	4	3	3	4	1	1	1	****	4.6
22	1	1	0	0	0	1	2	1	2	2	2	2	2	2	1	1	1	1	1	1	4	3	2	****	1.4
23	3	6	6	4	3	1	1	1	3	8	5	10	19	24	10	3	4	4	3	3	3	2	2	****	5.6
24	2	2	3	3	3	2	2	1	1	1	1	1	1	1	1	1	1	1	****	0	1	2	1	****	1.5
25	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	1	1	1	2	2	2	1	1	****	0.7
26	0	0	0	2	2	1	1	1	3	4	3	5	11	1	1	0	1	0	0	0	0	4	2	****	1.8
27	9	8	9	12	8	6	5	5	4	5	4	6	7	21	22	19	22	5	1	1	1	0	0	****	7.8
28	1	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	****	****	****	****	****	****	****	****	0.1
29	DATA MISSING																								
30	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	5	5	3	2	2	2	****	****
MEAN	2.9	2.4	2.4	2.5	2.3	2.1	2.1	1.9	2.8	3.3	3.2	3.8	4.8	4.5	3.7	3.7	3.6	2.8	2.4	2.0	2.0	2.4	2.1	****	2.8

PERCENTAGE OF DATA VALID 87.4

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 1781.00 TOTAL MONTHLY RECORD HOURS = 629.00

TABLE: F-130

OWMC AIR POLLUTION SURVEY

SULPHUR DIOXIDE

UNITS PPB

STATION LINCOLN COUNTY

MONTH MAY 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	1	2	2	2	1	0	1	1	1	1	1	19	3	1	0	1	0	2	3	3	****	2.0
2	2	1	1	1	1	1	1	0	0	1	2	2	0	1	2	1	1	1	2	1	0	1	3	****	1.1
3	0	0	1	2	0	2	0	0	0	1	2	0	1	1	0	2	1	0	0	0	0	0	0	****	0.6
4	0	****	6	5	3	3	3	3	5	4	3	4	1	3	0	0	0	0	0	0	2	1	0	****	2.1
5	2	2	1	5	3	5	3	2	3	2	2	3	4	2	****	****	****	0	0	0	2	12	13	****	3.3
6	1	2	2	2	1	1	1	3	4	4	1	3	4	6	****	3	6	12	12	9	2	4	3	****	3.9
7	1	0	0	3	3	2	1	1	2	1	1	1	1	1	0	0	0	1	4	1	1	1	1	****	1.2
8	1	2	1	1	0	0	0	0	5	5	6	5	2	3	15	13	9	10	8	0	0	5	5	****	4.2
9	2	3	9	10	6	5	7	8	8	12	59	75	65	56	22	35	61	56	34	35	50	12	3	****	27.5
10	6	15	5	5	14	6	9	6	4	2	2	2	2	2	3	8	4	1	4	2	2	2	3	****	4.7
11	5	4	5	6	7	10	12	14	21	24	19	19	106	74	75	****	4	2	2	****	3	3	4	****	20.0
12	5	6	2	1	2	0	0	6	8	10	13	20	10	4	9	10	4	3	3	1	0	0	0	****	5.1
13	0	0	1	1	0	0	0	1	1	1	2	5	2	0	0	0	0	0	0	0	0	0	0	****	0.6
14	3	3	2	2	2	3	2	4	7	9	13	15	14	13	11	13	12	9	7	4	10	3	2	****	7.1
15	5	2	2	5	4	4	3	3	3	8	16	****	****	****	0	0	0	8	8	18	5	1	1	****	4.8
16	4	2	2	2	2	1	1	3	6	7	9	7	16	13	11	15	5	2	1	1	1	2	2	****	5.0
17	2	2	5	13	19	17	15	14	12	8	6	5	6	6	8	5	4	3	6	5	8	10	4	****	8.0
18	4	2	3	2	1	1	0	1	1	0	0	1	2	2	1	1	2	2	2	1	1	1	2	****	1.4
19	0	1	1	1	1	1	1	1	2	3	3	3	3	3	5	6	2	2	2	3	6	3	2	****	2.4
20	1	1	1	1	1	1	1	1	1	0	0	0	0	1	1	1	1	0	1	1	1	1	1	****	0.8
21	27	10	3	10	10	7	2	4	10	29	51	21	8	6	9	16	5	9	9	8	7	5	7	****	11.9
22	41	17	18	6	7	8	8	11	13	12	11	16	13	13	19	12	16	6	22	8	5	3	2	****	12.5
23	1	3	4	3	2	2	1	1	2	3	4	2	1	2	2	0	0	0	0	0	1	2	1	****	1.6
24	2	4	6	8	5	3	3	5	10	10	11	12	11	10	9	9	7	3	4	7	6	5	3	****	6.7
25	2	2	2	1	1	2	2	4	5	4	5	3	5	6	11	8	3	2	2	3	4	1	1	****	3.4
26	0	0	0	0	0	0	1	3	4	3	3	3	3	5	10	10	6	3	3	3	4	11	8	****	3.6
27	2	1	1	1	1	1	2	2	4	13	12	12	14	11	6	4	1	1	5	9	43	16	5	****	7.3
28	7	5	3	4	5	6	6	12	15	14	14	11	8	7	10	5	4	4	8	4	2	4	6	****	7.1
29	****	11	10	8	5	3	3	4	6	5	4	7	5	3	5	4	4	3	4	4	3	3	4	****	4.9
30	****	3	2	2	4	7	6	6	6	6	7	5	4	9	5	4	6	4	5	5	7	56	15	****	7.9
31	1	0	0	0	3	3	1	3	6	5	4	3	3	3	3	2	3	2	2	1	1	1	1	****	2.2
MEAN	4.4	3.5	3.2	3.6	3.7	3.5	3.1	4.1	5.6	6.7	9.2	8.9	10.5	8.9	9.3	6.6	5.7	4.8	5.2	4.5	5.8	5.5	3.4	****	5.6

PERCENTAGE OF DATA VALID 94.2

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 3936.00 TOTAL MONTHLY RECORD HOURS = 701.00

TABLE F-131

Summary of Sulphur Dioxide Levels at OWMC Preferred Site (ppb)
June 1986 to May 1987

Month	Mean	Maximum Hourly Value	Minimum Hourly Value
1986			
June	4.8	38	0
July	3.1	63	0
August	3.9	90	0
September	3.3	45	0
October	3.6	47	0
November	6.6	66	0
December	6.0	40	0
1987			
January	7.1	53	0
February	5.2	47	0
March	4.7	70	0
April	2.8	24	0
May	5.6	106	0
Summer	3.9	90	0
Fall	4.5	66	0
Winter	6.1	53	0
Spring	4.4	106	0
Annual	4.7	106	0

TABLE: F-132

OWMC AIR POLLUTION SURVEY

NITRIC OXIDE (CHEMILUM.)

UNITS PPB

STATION LINCOLN COUNTY

MONTH JUN 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	****	****	****	****	****	0.0
2	DATA MISSING																								
3	0	0	0	0	0	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
4	****	****	****	****	****	****	****	****	****	5	5	5	3	1	1	1	0	0	0	0	0	0	****	0	1.5
5	0	0	0	0	0	****	****	****	****	****	****	****	****	0	0	0	0	0	0	0	0	0	0	****	0.0
6	4	2	2	2	2	2	1	1	****	****	****	****	****	****	****	****	****	****	****	****	****	1	1	1	****
7	0	0	0	0	0	0	0	0	1	1	2	5	5	5	5	5	5	5	5	5	5	5	5	5	2.9
8	4	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	0	0	2.8
9	0	0	0	0	0	0	0	0	0	0	****	****	****	****	****	****	****	4	4	4	4	4	4	3	1.6
10	3	4	4	4	4	4	7	9	7	6	4	4	4	4	4	4	4	4	4	4	4	4	4	5	4.5
11	4	4	4	5	5	5	5	5	5	7	6	6	6	6	5	5	5	5	5	5	5	5	5	7	5.2
12	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	6	5	4	4	4	4	6	4.9
13	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	5	5	4	4	4	3	3	3	4.0
14	3	3	3	3	5	3	3	3	3	4	4	4	4	3	3	3	3	3	3	3	3	3	3	****	3.3
15	****	****	4	4	4	4	4	4	4	4	5	4	4	4	4	3	3	3	3	3	3	4	4	****	3.8
16	****	****	4	4	4	4	4	4	4	4	4	5	4	4	4	****	****	****	4	2	0	0	0	****	3.3
17	0	0	0	0	0	0	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.2
18	****	****	****	0	0	0	0	0	0	3	2	0	0	0	1	2	2	0	0	1	1	1	****	****	0.7
19	1	2	2	3	3	2	1	0	2	4	5	4	6	4	3	3	3	3	3	3	3	3	****	****	2.9
20	1	1	2	2	2	3	1	2	2	2	2	2	1	0	0	1	1	0	0	0	0	0	****	****	1.1
21	DATA MISSING																								
22	DATA MISSING																								
23	****	****	****	****	****	****	****	****	****	****	****	****	****	4	2	4	4	4	5	4	3	3	****	****	****
24	0	0	1	3	3	4	4	4	4	3	3	3	3	3	3	3	3	3	3	3	3	****	****	****	2.8
25	****	****	****	****	****	****	****	****	****	****	****	****	****	****	2	1	0	3	4	4	3	3	3	****	****
26	1	2	0	1	1	2	0	0	2	****	****	****	****	****	****	5	6	7	7	7	7	7	7	****	3.6
27	****	****	****	****	****	****	****	****	****	****	****	****	9	6	5	5	4	3	3	2	2	2	****	****	****
28	1	2	2	2	2	3	1	2	2	1	1	1	1	2	3	3	2	1	1	2	2	1	****	****	1.7
29	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	****	****	0.5
30	0	0	0	0	0	0	0	3	3	2	1	1	1	0	0	0	0	****	****	****	****	****	****	****	0.6
MEAN	1.6	1.6	1.9	2.0	2.1	2.3	2.0	2.4	2.7	2.9	2.9	2.9	3.2	2.6	2.5	2.7	2.9	2.8	2.8	2.7	2.5	2.4	2.9	****	2.5

PERCENTAGE OF DATA VALID 69.2

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 1250.00 TOTAL MONTHLY RECORD HOURS = 498.00

TABLE: F-133

OWMC AIR POLLUTION SURVEY

NITRIC OXIDE (CHEMILUM.)

UNITS PPB

STATION LINCOLN COUNTY

MONTH JUL 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	1	0	0	0	****	****	****	2	1	0	0	0	****	****	0	0	2	2	2	2	****	****	0.7
2	2	3	4	4	4	3	3	3	4	6	7	8	5	2	1	1	1	2	2	3	3	1	****	****	3.3
3	0	0	0	0	0	0	0	1	2	3	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.3
4	0	1	1	1	2	2	7	4	3	2	3	3	2	2	2	2	1	1	2	2	3	2	****	****	2.2
5	2	2	2	3	3	3	4	3	4	4	5	4	5	5	7	6	7	5	5	4	4	3	****	****	4.1
6	3	4	3	3	2	2	3	3	5	5	5	6	5	4	5	4	3	3	4	4	3	3	****	****	3.7
7	4	3	3	3	3	3	3	4	4	5	5	4	4	4	3	3	4	5	5	4	3	3	****	****	3.7
8	2	3	2	2	2	2	4	4	4	4	4	5	3	2	2	2	8	2	10	3	3	2	****	****	3.4
9	2	2	2	2	1	1	1	1	2	2	3	8	7	1	1	0	0	1	0	0	0	0	****	****	1.7
10	0	0	0	0	0	0	1	5	3	1	2	0	0	0	0	0	0	0	0	0	0	0	****	****	0.5
11	0	0	1	1	****	****	****	****	5	7	4	3	3	2	3	3	2	1	1	1	1	1	****	****	2.2
12	1	1	1	2	2	1	2	2	2	2	2	2	1	2	2	2	2	2	1	2	1	1	****	****	1.6
13	0	1	1	1	2	2	2	3	2	3	2	3	2	3	3	2	2	2	2	2	1	1	****	****	1.9
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
15	0	0	0	0	0	0	1	3	4	3	2	1	0	0	0	2	4	5	1	0	0	0	****	****	1.2
16	0	0	1	1	1	1	1	2	2	1	2	2	2	2	2	2	2	3	7	4	2	1	****	****	1.9
17	1	1	1	1	1	1	1	2	3	3	2	1	5	2	1	2	3	3	3	3	2	2	****	****	2.0
18	3	1	0	0	2	1	1	2	2	2	2	1	1	3	0	0	0	0	0	0	0	0	****	****	1.0
19	0	0	0	0	0	1	1	1	0	1	1	0	0	1	0	0	0	0	1	0	0	0	****	****	0.3
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
22	0	0	0	0	0	0	0	2	3	0	0	0	0	0	1	1	1	1	1	1	1	1	****	****	0.6
23	0	0	0	0	0	0	0	1	1	3	3	1	1	1	1	1	1	1	0	0	0	0	****	****	0.7
24	1	1	0	0	0	0	0	2	2	0	0	0	1	1	1	1	0	0	0	1	1	0	****	****	0.5
25	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	****	****	0.1
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
28	0	3	3	1	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.5
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
30	0	0	0	0	0	0	0	0	0	2	3	3	2	0	2	0	0	0	0	0	0	0	****	****	0.5
31	0	0	0	0	0	0	0	3	1	0	1	0	0	0	****	0	0	0	0	0	0	0	****	****	0.2
MEAN	0.7	0.8	0.8	0.8	0.8	0.8	1.3	1.8	2.0	2.0	1.9	1.8	1.6	1.2	1.3	1.1	1.3	1.2	1.5	1.2	1.0	0.7	****	****	1.3

PERCENTAGE OF DATA VALID 90.3

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 842.00 TOTAL MONTHLY RECORD HOURS = 672.00

TABLE: F-134

OWMC AIR POLLUTION SURVEY

NITRIC OXIDE (CHEMILUM.)

UNITS PPB

STATION LINCOLN COUNTY

MONTH AUG 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	0	0	0	0	0	0	0	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
2											DATA MISSING														
3											DATA MISSING														
4											DATA MISSING														
5											DATA MISSING														
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
8	0	0	0	****	****	40	20	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	3.0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	4	2	2	****	****	0.6
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
13	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
15	0	0	0	0	3	2	0	0	1	0	2	3	3	2	1	0	0	2	0	0	0	0	****	****	0.9
16	0	0	0	0	0	0	0	1	2	1	1	0	0	1	3	4	3	3	2	1	0	0	****	****	1.0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
18	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	****	****	****	****	0.2
19	0	0	0	0	0	0	0	0	****	****	****	****	****	****	****	****	****	2	0	1	0	1	****	****	0.3
20											DATA MISSING														
21											DATA MISSING														
22											DATA MISSING														
23											DATA MISSING														
24											DATA MISSING														
25	****	****	****	****	****	****	****	****	****	****	****	****	0	0	0	0	0	0	0	0	0	0	****	****	****
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
29	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	1	0	0	0	0	0	****	****	0.2
30	0	0	0	0	0	0	0	0	2	2	2	2	4	2	1	0	0	0	0	0	0	0	****	****	0.7
31	1	0	0	0	0	0	0	1	2	3	2	1	0	0	0	0	0	0	0	0	0	0	****	****	0.5
MEAN	0.0	0.0	0.0	0.0	0.2	2.0	1.0	0.1	0.5	0.4	0.7	0.3	0.3	0.3	0.3	0.2	0.2	0.4	0.2	0.3	0.1	0.2	****	****	0.3

PERCENTAGE OF DATA VALID 63.3

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 156.00 TOTAL MONTHLY RECORD HOURS = 471.00

TABLE: F-135

OWMC AIR POLLUTION SURVEY

NITRIC OXIDE (CHEMILUM.)

UNITS PPB

STATION LINCOLN COUNTY

MONTH SEP 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	0	0	0	0	1	2	2	2	1	0	0	0	0	0	0	0	0	0	0	****	****	0.4
2	****	0	0	0	0	0	0	2	7	5	3	1	0	0	0	0	0	0	0	0	0	0	****	****	0.9
3	0	0	0	0	0	0	0	2	7	5	2	2	2	1	2	2	2	2	2	1	1	0	****	****	1.5
4	0	0	0	0	0	1	0	1	1	1	0	0	2	2	1	1	0	0	0	0	0	0	****	****	0.5
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
6	0	0	0	0	0	0	0	1	2	3	2	0	0	0	0	0	1	0	0	0	0	0	****	****	0.4
7	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
8	0	0	0	0	0	0	0	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.2
9	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	****	****	0.1
10	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2	3	2	0	0	0	0	0	****	****	0.4
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
13	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	****	****	0.1
14	0	0	0	0	0	0	0	0	5	4	1	0	0	0	0	0	0	0	0	0	0	0	****	****	0.5
15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	18	14	6	3	3	1	8	1	****	****	2.5
16	3	3	3	3	5	5	10	3	6	6	9	11	7	5	4	3	0	0	0	0	0	0	****	****	3.9
17											DATA MISSING														
18	****	****	****	****	****	****	****	****	****	****	****	****	****	0	0	0	0	0	0	0	0	0	****	****	****
19	5	5	5	5	8	10	3	5	5	5	5	5	10	5	5	5	5	5	5	5	5	5	****	****	5.5
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
22	0	0	0	0	0	0	0	0	0	3	0	0	0	****	****	****	0	0	0	0	0	5	****	****	0.4
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	****	0	0	0	0	0	****	****	0.0
24	0	0	0	0	0	0	0	3	8	8	3	0	0	0	0	3	0	3	0	0	0	0	****	****	1.3
25	0	0	3	3	0	0	5	15	10	5	5	3	0	3	8	3	5	****	0	0	0	0	****	****	3.2
26	10	8	8	8	5	0	0	0	0	0	5	3	3	3	0	0	0	0	0	0	0	0	****	****	2.4
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
28	0	0	0	0	0	0	0	0	0	0	3	3	3	3	0	0	0	0	0	0	0	0	****	****	0.5
29	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	****	****	0	0	0	0	0	****	****	0.0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
MEAN	0.7	0.6	0.7	0.7	0.6	0.6	0.6	1.2	2.0	1.8	1.5	1.1	1.0	0.9	1.5	1.3	0.8	0.5	0.3	0.2	0.5	0.4	****	****	0.9

PERCENTAGE OF DATA VALID 85.1

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 537.00 TOTAL MONTHLY RECORD HOURS = 613.00

TABLE: F-136

OWMC AIR POLLUTION SURVEY

NITRIC OXIDE (CHEMILUM.)

UNITS PPB

STATION LINCOLN COUNTY

MONTH OCT 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1																									
2											DATA MISSING														
3											DATA MISSING														
4											DATA MISSING														
5											DATA MISSING														
6											DATA MISSING														
7	0	0	0	0	0	0	0	0	0	0	1	8	5	0	0	5	0	0	0	0	****	****	****	****	0.9
8	1	1	1	1	1	2	2	2	2	2	2	9	9	10	9	2	5	8	6	4	1	2	****	****	3.7
9	4	4	1	0	0	0	0	0	0	0	0	0	0	0	0	****	****	****	****	****	****	****	****	****	0.6
10	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
11	0	0	0	0	0	0	0	0	1	4	6	2	1	0	1	1	0	0	0	0	0	0	****	****	0.7
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	****	****	0.3
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	****	****	0.0
14	0	0	0	0	0	0	0	0	0	4	1	1	1	1	6	3	0	0	0	0	0	0	****	****	0.8
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
16	0	0	0	0	0	0	0	0	1	1	2	1	0	0	0	0	0	0	0	0	0	0	****	****	0.2
17	0	0	0	0	0	2	17	3	0	2	3	0	0	0	0	0	0	0	0	0	0	0	****	****	1.2
18	0	0	0	7	2	18	14	12	11	12	7	2	2	4	4	2	1	0	0	0	0	0	****	****	4.5
19	12	1	0	2	4	3	2	1	2	8	5	2	3	3	3	2	4	5	3	3	3	1	****	****	3.3
20	1	0	0	0	0	0	0	0	3	4	6	3	3	2	3	1	0	0	0	0	0	0	****	****	1.2
21	0	0	0	0	0	0	0	0	0	2	2	1	0	0	0	0	0	0	0	0	0	0	****	****	0.2
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
23	2	1	1	1	1	1	1	1	1	3	3	2	2	0	0	0	0	0	0	0	0	0	****	****	0.9
24	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
25	6	6	6	5	5	5	5	5	8	5	6	7	8	6	8	8	2	0	0	0	0	0	****	****	4.6
26	0	0	0	0	0	0	0	0	1	4	6	4	4	4	2	1	0	0	0	0	0	0	****	****	1.2
27	1	1	8	8	6	3	1	2	4	3	2	1	1	0	0	0	0	0	0	0	0	0	****	****	1.9
28	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0	0	****	****	0.2
29	0	0	0	0	0	1	1	1	2	2	3	3	0	1	0	0	0	0	0	0	0	0	****	****	0.6
30	0	0	0	0	0	0	0	0	0	0	2	5	2	3	3	1	0	0	0	0	12	2	****	****	1.4
31	17	12	9	10	8	0	0	3	6	4	1	1	1	0	1	0	0	0	0	0	0	0	****	****	3.3
MEAN	1.8	1.0	1.0	1.4	1.1	1.4	1.7	1.2	1.7	2.5	2.3	2.1	1.7	1.5	1.6	1.1	0.5	0.6	0.4	0.3	0.7	0.5	****	****	1.3

PERCENTAGE OF DATA VALID 72.7

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 695.00 TOTAL MONTHLY RECORD HOURS = 541.00

TABLE: F-137

OWMC AIR POLLUTION SURVEY

NITRIC OXIDE (CHEMILUM.)

UNITS PPB

STATION LINCOLN COUNTY

MONTH NOV 1986

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	1	1	0	0	0	0	0	1	2	4	5	4	4	3	3	2	1	1	1	0	0	0	****	****	1.5
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
3	2	1	0	0	1	0	0	2	6	3	2	2	3	1	0	0	0	0	0	0	0	0	****	****	1.0
4	1	1	0	0	1	0	0	0	0	1	1	3	2	3	2	2	1	0	0	0	0	0	****	****	0.8
5	1	1	0	0	0	0	0	1	8	11	11	****	****	****	****	****	****	****	****	****	****	****	****	****	****
6											DATA MISSING														
7	****	****	****	****	****	****	****	****	****	****	****	****	12	19	13	20	14	12	18	27	29	25	****	****	****
8	13	9	9	12	15	11	4	2	3	6	7	7	8	6	3	2	2	1	1	1	1	0	****	****	5.6
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
11	7	0	0	0	0	0	0	0	0	0	3	3	3	0	0	0	0	0	0	0	0	0	****	****	0.7
12	0	0	0	0	0	0	0	0	0	16	8	1	17	8	2	****	****	0	0	0	0	0	****	****	2.6
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
14	0	0	0	0	0	0	0	0	0	0	0	2	1	1	0	0	0	0	0	0	0	0	****	****	0.2
15	0	0	0	0	0	0	0	0	0	1	2	2	14	1	0	0	0	0	0	0	0	0	****	****	0.9
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
17	0	0	0	0	0	0	0	0	2	0	1	3	4	4	2	1	0	0	0	0	0	0	****	****	0.8
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0	0	0	0	0	0	****	****	0.0
20	0	0	0	0	0	0	0	0	1	2	2	3	7	7	2	1	****	****	12	18	7	0	****	****	3.1
21	16	3	0	0	0	0	0	0	2	5	5	5	5	2	1	1	0	0	0	0	0	0	****	****	2.0
22	0	0	0	0	0	0	0	1	5	7	4	4	3	5	2	1	0	0	0	0	0	0	****	****	1.5
23	0	0	0	10	14	0	0	0	2	4	6	6	6	3	2	1	0	0	0	1	1	0	****	****	2.5
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	****	****	****	0	0	****	****	0.2
25	0	0	0	0	0	0	0	0	1	3	2	4	3	6	5	3	0	0	0	0	1	2	****	****	1.4
26	4	44	88	80	72	59	36	32	54	64	41	8	2	1	1	2	0	10	31	10	2	0	****	****	29.1
27	0	0	0	0	0	0	0	0	0	2	3	1	****	****	4	2	0	0	0	0	0	0	****	****	0.6
28	0	0	0	0	0	0	0	0	13	22	0	****	****	****	****	****	9	2	1	1	1	0	****	****	2.9
29	1	0	0	0	0	0	0	0	5	5	7	5	1	1	1	1	0	0	0	0	0	0	****	****	1.2
30	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
MEAN	1.7	2.1	3.5	3.6	3.7	2.5	1.4	1.4	3.7	5.6	3.9	2.4	3.7	2.7	1.7	1.6	1.1	1.0	2.4	2.1	1.5	1.0	****	****	2.5

PERCENTAGE OF DATA VALID 83.2

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 1487.00 TOTAL MONTHLY RECORD HOURS = 599.00

TABLE: F-138

OWMC AIR POLLUTION SURVEY

NITRIC OXIDE (CHEMILUM.)

UNITS PPB

STATION LINCOLN COUNTY

MONTH DEC 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	3	2	2	2	2	2	2	2	2	3	3	4	****	****	3	2	0	0	0	0	0	0	****	****	1.7
2	0	0	0	1	1	1	1	1	2	3	5	21	23	14	21	22	9	1	1	1	1	1	****	****	5.9
3	1	1	1	1	1	1	1	1	4	10	19	24	31	17	4	2	****	****	****	1	4	2	****	****	6.6
4	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	****	****	0.1
5	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	****	****	0.2
6	1	0	0	0	0	0	0	0	1	2	4	4	2	5	4	4	2	0	0	0	0	0	****	****	1.3
7	9	8	11	10	3	1	2	0	1	2	3	1	3	1	0	3	0	0	0	0	0	0	****	****	2.6
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0	0	0	****	****	0	0.0
9	0	0	0	0	0	0	0	0	5	12	25	31	28	41	44	35	35	95	119	71	26	****	****	0	25.8
10	0	0	0	0	0	0	0	0	0	0	0	1	1	2	1	****	0	0	0	0	0	****	****	0	0.2
11	0	0	0	0	0	0	0	0	0	3	2	2	2	2	2	2	2	0	0	0	0	****	****	4	1.0
12	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0	0.5
13	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	****	****	0	0.2
14	0	0	0	0	0	0	0	0	1	6	12	7	5	1	0	2	0	1	0	0	0	****	****	1	1.6
15	1	1	1	0	0	1	1	0	1	1	1	2	13	2	****	****	****	****	0	0	0	****	****	1	1.4
16	0	0	0	0	0	0	0	1	4	9	6	5	3	4	7	5	10	9	15	14	11	****	****	29	6.0
17	26	23	27	21	22	34	46	52	51	41	22	12	18	25	16	4	****	****	****	****	****	****	****	****	27.5
18											DATA MISSING														
19											DATA MISSING														
20											DATA MISSING														
21											DATA MISSING														
22	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	3	****
23	0	0	0	0	0	0	0	0	0	1	1	2	3	3	4	3	1	0	0	0	0	****	****	3	1.0
24	1	0	0	0	0	0	0	0	0	2	4	4	6	3	1	0	0	0	0	0	0	****	****	0	1.0
25	****	****	****	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	1	0.1
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	1	0.0
27	0	0	0	0	0	0	0	0	1	0	0	0	2	2	1	0	0	0	0	1	1	****	****	1	0.4
28	0	0	0	0	0	0	0	0	0	0	1	2	1	0	0	4	3	0	0	0	0	****	****	0	0.5
29	0	0	0	0	0	0	0	0	0	1	3	3	4	3	2	2	0	0	16	10	4	****	****	22	3.2
30	13	16	19	21	38	28	28	25	22	18	6	1	2	22	28	2	0	0	0	10	5	****	****	1	13.9
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0	0.0
MEAN	2.7	2.1	2.4	2.2	2.6	2.6	3.1	3.2	3.7	4.4	4.6	5.0	5.9	5.9	5.6	3.9	2.7	4.8	6.3	4.3	2.1	****	****	3.5	3.7

PERCENTAGE OF DATA VALID 74.3

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 2068.00 TOTAL MONTHLY RECORD HOURS = 553.00

TABLE: F-139

OWMC AIR POLLUTION SURVEY

NITRIC OXIDE (CHEMILUM.)

UNITS PPB

STATION LINCOLN COUNTY

MONTH JAN 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	****	****	0	0.0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0	0.0
3	0	0	0	0	0	0	0	0	0	0	2	2	1	1	1	0	0	0	0	0	0	****	****	0	0.3
4	0	0	0	0	0	0	0	0	1	5	8	8	9	8	6	4	2	0	3	2	0	****	****	6	2.8
5	3	0	0	5	10	13	11	15	23	25	19	17	9	4	2	1	0	0	1	0	1	****	****	2	7.3
6	1	2	2	0	0	0	0	0	2	11	12	8	10	10	14	12	5	0	0	0	0	****	****	2	4.1
7	0	1	1	1	1	0	0	0	1	2	3	5	4	3	2	3	1	0	0	0	0	****	****	3	1.4
8	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0	0.1
9	0	0	0	0	0	0	0	0	0	1	1	2	2	2	3	0	0	0	0	0	0	****	****	20	1.4
10	5	0	0	0	0	0	1	1	5	12	16	16	13	10	6	4	3	1	1	1	0	****	****	0	4.3
11	0	6	7	7	4	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	****	****	1	1.3
12	0	0	0	0	0	0	0	0	0	1	2	2	1	2	2	1	0	0	0	0	0	****	****	1	0.5
13	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	****	****	2	0.3
14	1	1	0	0	1	1	1	2	6	12	17	10	10	11	12	4	2	1	1	27	18	****	****	2	6.4
15	2	1	1	1	2	2	1	1	3	3	4	4	7	4	2	1	1	1	1	0	0	****	****	2	2.0
16	2	2	1	1	1	1	1	1	1	1	2	2	2	1	1	2	1	1	1	1	0	****	****	0	1.2
17	1	1	1	1	1	1	0	0	0	2	14	4	8	5	1	1	0	0	0	0	0	****	****	2	2.0
18	1	0	1	1	1	1	2	2	3	5	8	11	15	10	7	5	2	1	0	1	0	****	****	2	3.6
19	3	1	1	1	1	1	1	1	3	2	1	0	1	1	1	1	1	1	1	1	1	****	****	0	1.1
20	0	0	0	0	0	0	0	0	1	3	3	5	3	2	8	2	0	0	0	1	1	****	****	2	1.4
21	0	0	0	0	0	0	0	0	3	6	5	4	2	5	8	2	2	0	0	0	0	****	****	0	1.7
22	0	0	0	0	0	0	0	0	0	2	3	4	4	3	4	3	3	0	0	0	0	****	****	0	1.2
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0	0.0
24	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	****	****	0	0.2
25	0	0	0	0	0	0	0	0	1	2	3	2	2	1	1	1	1	0	0	0	0	****	****	****	0.7
26	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	6	3	3	****	****	****	****	****	****
27	****	****	****	****	****	****	****	****	****	****	****	11	10	10	13	5	2	0	0	0	0	****	****	2	****
28	1	1	1	1	1	1	1	2	7	9	8	9	8	11	10	****	****	31	16	12	10	****	****	8	7.4
29	6	5	5	4	4	4	4	3	6	10	10	9	9	8	13	11	****	****	1	0	0	****	****	0	5.6
30	1	0	0	0	1	0	0	1	2	4	5	5	7	7	10	8	6	4	0	0	0	****	****	0	2.8
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	****	****	0	0.1
MEAN	1.0	0.8	0.7	0.8	1.0	0.9	0.8	1.0	2.3	4.1	5.1	4.7	4.6	4.0	4.3	2.5	1.3	1.5	0.9	1.5	1.0	****	****	2.0	2.1

PERCENTAGE OF DATA VALID 87.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 1386.00 TOTAL MONTHLY RECORD HOURS = 647.00

TABLE: F-140

OWMC AIR POLLUTION SURVEY

NITRIC OXIDE (CHEMILUM.)

UNITS PPB

STATION LINCOLN COUNTY

MONTH FEB 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	0	0	0	0	0	1	1	2	2	3	6	6	4	4	0	0	0	0	****	****	1	1.4
2	0	0	0	0	0	1	0	0	4	5	5	6	5	6	6	6	4	0	0	0	0	****	****	1	2.2
3	1	2	1	1	1	1	1	1	3	3	4	9	11	9	3	1	0	0	0	0	0	****	****	0	2.4
4	0	0	0	0	0	0	0	0	0	0	0	2	1	1	0	0	0	0	0	0	0	****	****	2	0.3
5	1	0	0	0	0	0	0	0	1	1	1	1	18	8	8	15	1	0	0	0	0	****	****	1	2.5
6	0	0	0	0	0	0	0	1	7	11	11	15	17	16	14	8	3	4	0	0	0	****	****	1	4.9
7	0	0	0	0	0	0	0	0	1	1	2	2	1	1	1	0	1	0	0	0	0	****	****	1	0.5
8	0	0	0	0	0	0	0	0	1	1	3	3	1	0	1	0	0	0	0	0	0	****	****	1	0.5
9	0	0	0	0	0	0	0	0	5	21	27	16	6	8	3	1	1	0	0	0	0	****	****	3	4.1
10	2	4	2	0	0	0	0	0	2	4	****	****	****	****	****	****	****	1	1	1	0	****	****	1	1.2
11	0	0	0	0	0	0	0	0	5	7	9	13	7	7	7	5	3	1	0	0	0	****	****	0	2.9
12	0	2	41	27	11	5	0	0	6	8	6	8	4	3	3	2	5	3	0	0	0	****	****	0	6.1
13	0	0	0	0	0	0	0	0	1	3	6	7	6	5	4	3	1	0	0	0	0	****	****	1	1.7
14	3	1	0	0	0	0	0	0	1	2	4	3	4	2	1	1	0	0	0	0	0	****	****	1	1.0
15	0	0	0	0	0	0	0	0	1	2	2	2	5	4	2	1	1	0	0	0	0	****	****	1	1.0
16	0	1	0	0	0	0	0	0	4	6	3	2	2	2	2	4	4	1	0	0	0	****	****	1	1.5
17	0	0	0	0	0	0	0	0	4	5	3	2	1	1	2	1	1	1	0	0	0	****	****	1	1.0
18	1	0	0	0	1	1	1	2	5	6	1	1	2	3	2	2	6	7	0	0	0	****	****	1	1.9
19	0	0	0	0	0	0	0	3	9	12	6	2	2	5	7	4	0	0	0	0	0	****	****	0	2.3
20	0	0	0	0	0	0	1	8	13	12	8	3	1	1	2	1	1	0	0	0	0	****	****	1	2.4
21	0	0	0	0	0	0	0	1	12	7	5	4	3	2	1	1	0	2	1	1	1	****	****	2	2.0
22	2	2	8	16	14	14	3	15	16	11	8	7	6	5	2	3	3	2	0	0	1	****	****	1	6.3
23	0	0	0	0	1	1	0	1	4	11	14	20	10	7	2	****	****	****	1	1	1	****	****	1	3.9
24	1	0	1	0	0	0	0	1	6	5	4	4	5	2	3	2	1	0	0	0	0	****	****	1	1.6
25	0	0	0	0	0	0	0	3	13	10	11	12	6	7	6	5	2	0	0	0	0	****	****	0	3.4
26	1	0	0	0	0	0	0	2	5	7	7	2	2	2	3	6	4	2	1	1	0	****	****	1	2.1
27	1	0	0	1	1	2	7	8	9	5	5	8	7	5	4	3	3	2	1	1	1	****	****	3	3.5
28	2	1	1	3	4	1	1	1	1	5	17	11	4	6	9	6	4	2	1	1	1	****	****	****	3.9
MEAN	0.5	0.5	1.9	1.7	1.2	0.9	0.5	1.7	5.0	6.1	6.4	6.2	5.2	4.6	3.9	3.3	2.0	1.0	0.2	0.2	0.2	****	****	1.0	2.4

PERCENTAGE OF DATA VALID 90.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 1482.00 TOTAL MONTHLY RECORD HOURS = 605.00

TABLE: F-141

OWMC AIR POLLUTION SURVEY

NITRIC OXIDE (CHEMILUM.)

UNITS PPB

STATION LINCOLN COUNTY

MONTH MAR 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	1	0	0	0	1	1	2	3	4	5	7	8	7	10	13	11	8	7	5	10	7	****	****	2	5.1
2	2	3	2	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0	0.6
3	0	0	0	0	0	0	0	0	0	5	****	****	****	****	****	****	****	****	****	0	****	****	****	1	0.5
4	0	0	0	0	0	0	0	1	3	4	3	2	****	****	3	1	0	0	0	0	0	****	****	1	0.9
5	0	0	0	0	0	0	0	0	1	2	1	1	1	****	****	2	2	1	0	0	0	****	****	3	0.7
6	0	2	1	1	2	1	1	4	8	11	12	15	14	15	14	24	17	7	3	1	1	****	****	1	7.0
7	1	1	2	2	2	2	2	5	9	10	8	9	9	9	8	6	5	3	1	2	2	****	****	2	4.5
8	2	1	1	1	1	1	1	1	2	3	6	8	5	4	4	4	2	1	0	0	0	****	****	1	2.2
9	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	1	0.3
10	1	1	1	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	****	****	0	0.4
11	0	0	0	1	6	7	1	3	9	6	4	3	3	2	3	2	2	2	1	1	1	****	****	2	2.7
12	1	1	1	1	0	0	1	13	19	17	11	8	12	7	3	1	1	1	0	0	0	****	****	2	4.5
13	1	1	1	1	0	0	0	2	2	3	3	2	2	1	1	0	0	0	0	0	0	****	****	1	1.0
14	1	1	0	1	1	1	1	3	3	3	3	2	2	2	1	1	1	1	1	1	1	****	****	2	1.5
15	1	1	1	1	1	1	1	2	2	1	1	0	0	0	0	0	0	0	0	0	0	****	****	1	0.6
16	0	0	0	0	0	1	1	3	2	3	0	1	0	0	0	0	0	1	0	0	0	****	****	1	0.6
17	1	0	0	0	0	0	0	2	6	9	8	6	4	3	0	1	1	2	0	0	0	****	****	1	2.0
18	0	0	1	1	1	0	0	4	6	2	2	1	2	0	0	0	0	0	0	0	0	****	****	1	1.0
19	1	1	1	4	12	8	6	4	9	13	8	3	4	4	3	2	1	1	0	0	0	****	****	2	4.0
20	1	1	1	0	0	0	0	1	4	10	8	5	4	3	3	4	2	1	2	1	1	****	****	2	2.5
21	1	1	1	1	0	1	1	3	6	8	5	4	3	4	4	4	3	3	1	1	1	****	****	2	2.6
22	1	1	1	1	1	1	1	3	5	4	4	4	4	3	3	3	3	3	3	2	2	****	****	1	2.5
23	1	1	0	0	0	0	2	8	7	7	4	2	11	8	6	3	3	2	1	1	1	****	****	0	3.1
24	0	0	0	0	0	0	2	7	7	4	1	1	0	4	2	4	4	3	1	0	0	****	****	1	1.9
25	0	0	0	0	0	0	0	1	3	3	3	4	7	7	6	5	5	5	5	4	3	****	****	3	2.9
26	2	2	1	0	0	0	0	0	1	2	5	8	12	3	2	2	3	2	2	1	1	****	****	1	2.3
27	1	1	1	0	0	0	0	3	3	2	3	4	4	4	3	2	1	1	1	2	10	****	****	15	2.8
28	15	14	8	4	3	1	1	3	7	6	6	3	3	3	3	3	2	1	1	1	0	****	****	0	4.0
29	1	1	1	1	2	0	0	3	6	3	4	4	5	5	4	4	3	3	3	3	15	****	****	2	3.3
30	1	1	1	2	2	2	2	2	3	3	3	4	5	5	7	2	1	1	2	3	0	****	****	0	2.4
31	0	0	0	0	0	0	0	0	0	0	1	3	2	1	0	0	0	0	0	0	0	****	****	1	0.4
MEAN	1.2	1.2	0.9	0.8	1.2	1.0	0.9	2.7	4.5	4.8	4.2	3.9	4.3	3.9	3.3	3.1	2.3	1.7	1.1	1.1	1.5	****	****	1.7	2.3

PERCENTAGE OF DATA VALID 89.8

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 1546.00 TOTAL MONTHLY RECORD HOURS = 668.00

TABLE: F-142

OWMC AIR POLLUTION SURVEY

NITRIC OXIDE (CHEMILUM.)

UNITS PPB

STATION LINCOLN COUNTY

MONTH APR 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	0	0	0	0	2	7	4	3	3	1	1	1	1	1	0	0	0	0	****	****	1	1.1
2	0	0	0	0	0	0	1	0	2	1	1	0	0	1	1	****	****	0	0	0	0	****	****	1	0.4
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	1	0.0
4	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	****	****	1	0.6
5	2	2	1	2	1	1	1	1	1	1	1	1	1	0	2	1	1	1	1	1	1	1	****	****	1.1
6	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	****	****	1.6
7	2	2	2	2	2	1	1	1	6	12	13	6	7	4	4	3	2	2	2	0	0	0	****	****	3.4
8	0	0	0	0	0	0	0	1	5	10	10	11	9	6	3	1	1	3	1	0	0	****	****	0	2.8
9	0	0	0	0	0	0	0	2	5	5	5	2	1	0	2	2	1	1	1	0	0	****	****	0	1.2
10	0	0	0	0	0	0	0	1	4	6	6	7	9	7	4	3	2	2	1	0	0	****	****	0	2.4
11	0	0	0	0	0	0	0	0	1	2	1	6	7	4	4	2	2	1	2	2	2	****	****	1	1.7
12	1	0	0	0	0	0	0	1	3	7	3	2	2	3	3	3	2	2	2	2	1	****	****	1	1.7
13	1	1	1	1	1	1	1	2	5	4	2	2	1	****	****	****	****	****	****	1	1	****	****	1	1.6
14	1	1	1	1	1	1	1	3	3	3	2	2	5	7	5	4	3	2	3	3	3	****	****	2	2.6
15	3	3	3	3	3	2	2	3	6	4	4	4	4	12	13	5	3	3	3	3	2	****	****	1	4.0
16	1	1	1	1	0	0	0	0	0	0	3	7	4	2	3	2	3	3	2	1	1	****	****	1	1.6
17	1	1	1	1	1	1	2	2	2	3	3	2	3	3	4	4	4	4	3	2	1	****	****	1	2.2
18	1	1	1	1	1	1	1	1	2	5	4	2	2	2	1	1	2	2	2	1	1	****	****	0	1.6
19	1	1	1	1	1	1	1	1	1	2	3	4	5	3	3	2	2	2	2	1	1	****	****	1	1.8
20	1	1	1	1	1	1	1	3	5	5	8	9	6	3	2	2	2	1	1	0	0	****	****	0	2.5
21	0	0	1	3	0	0	0	3	5	****	****	3	4	3	3	3	2	2	2	2	1	****	****	0	1.9
22	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	1	0	0	0	****	****	0	0.4
23	0	0	0	0	1	1	1	1	3	5	4	3	6	6	5	5	6	4	2	2	1	****	****	1	2.6
24	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0	0.1
25	0	0	0	0	0	0	0	1	1	1	0	1	1	1	0	0	1	1	8	2	0	****	****	0	0.8
26	0	0	0	0	0	0	0	1	2	3	1	1	2	0	2	1	1	0	0	0	0	****	****	0	0.6
27	0	0	0	0	0	0	0	3	4	3	2	2	2	5	4	2	2	3	3	2	2	****	****	2	1.9
28	2	2	1	1	1	2	2	2	2	2	3	3	2	2	3	3	****	****	0	0	0	****	****	0	1.6
29	0	0	0	0	0	0	0	0	1	0	0	0	2	1	0	0	0	0	****	****	0	****	****	0	0.2
30	0	0	0	0	0	0	0	0	2	2	2	1	1	1	2	****	****	0	0	0	0	****	****	1	0.6
MEAN	0.6	0.6	0.5	0.7	0.5	0.5	0.5	1.2	2.6	3.2	3.0	2.9	3.0	2.8	2.7	2.0	1.8	1.5	1.6	1.0	0.7	****	****	0.6	1.6

PERCENTAGE OF DATA VALID 89.4

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 1009.00 TOTAL MONTHLY RECORD HOURS = 644.00

TABLE: F-143

OWMC AIR POLLUTION SURVEY

NITRIC OXIDE (CHEMILUM.)

UNITS PPB

STATION LINCOLN COUNTY

MONTH MAY 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	0	0	0	0	2	2	0	1	1	0	1	7	2	1	0	0	0	0	****	****	0	0.8
2	0	0	0	0	0	0	0	1	3	3	3	5	3	3	2	2	2	2	1	1	0	****	****	1	1.5
3	1	1	0	0	0	0	1	1	1	2	2	3	2	2	1	1	1	1	1	2	1	****	****	2	1.2
4	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	****	****	0	0.2
5	0	0	0	0	0	0	0	3	4	4	3	2	2	1	0	0	0	0	0	0	0	****	****	0	0.9
6	0	0	0	0	0	0	0	2	2	2	1	1	0	1	****	****	4	2	1	0	0	****	****	1	0.9
7	0	0	0	0	0	0	0	1	3	3	3	3	1	0	0	0	0	0	0	0	0	****	****	2	0.7
8	1	1	0	0	0	0	1	5	5	1	0	0	0	0	2	1	1	2	1	0	0	****	****	0	1.0
9	0	0	0	0	0	0	0	1	2	3	10	13	10	7	2	3	5	5	1	2	0	****	****	1	3.0
10	1	1	1	1	1	1	2	2	3	5	4	4	4	4	3	3	4	3	3	3	3	****	****	2	2.6
11	3	3	3	3	4	4	3	3	3	4	2	2	20	19	9	0	0	0	0	0	****	****	****	0	4.0
12	0	1	0	0	0	0	0	****	****	****	****	****	****	****	****	5	2	2	2	1	0	****	****	0	0.9
13	0	0	0	0	0	0	2	5	3	3	4	3	3	2	2	1	1	1	1	1	1	****	****	1	1.5
14	1	2	1	2	2	1	1	2	3	3	4	4	4	4	3	4	4	4	4	4	1	****	****	1	2.7
15	1	1	1	0	0	1	1	2	4	5	9	6	4	****	****	3	3	5	4	4	1	****	****	1	2.8
16	1	1	2	1	1	3	5	6	7	6	4	4	6	5	3	3	1	1	0	2	1	****	****	1	2.9
17	1	1	1	1	1	2	2	4	5	5	5	5	****	****	****	****	****	****	****	****	****	****	****	****	2.8
18	2	1	1	1	2	2	2	2	2	2	3	4	5	4	3	3	3	2	2	2	2	****	****	1	2.3
19	1	1	1	1	1	1	1	2	3	4	5	5	4	4	5	5	5	5	4	3	3	****	****	3	3.0
20	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	****	****	1	2.0
21	1	1	2	2	2	2	2	3	3	6	8	6	4	4	3	4	3	6	6	5	4	****	****	2	3.6
22	2	2	2	2	2	2	2	3	5	5	5	5	3	4	5	4	5	3	5	3	3	****	****	2	3.4
23	2	2	2	2	2	1	2	2	2	3	3	2	2	2	2	2	1	1	1	1	1	****	****	1	1.8
24	0	0	0	0	1	1	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	****	****	1	1.0
25	1	1	1	1	1	1	4	4	3	3	3	3	4	3	5	4	3	2	2	2	2	****	****	1	2.5
26	0	0	0	0	0	0	0	1	2	4	9	8	10	10	3	1	5	4	3	2	1	****	****	0	2.9
27	0	0	0	0	0	0	0	1	1	2	2	2	1	1	1	0	0	0	0	0	0	****	****	0	0.5
28	0	0	0	0	0	0	0	0	1	2	2	1	1	1	1	0	0	1	1	0	0	****	****	0	0.5
29	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	****	****	0	0.2
30	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	1	0	0	0	1	****	****	0	0.4
31	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	****	****	0	0.5
MEAN	0.7	0.7	0.6	0.6	0.7	0.8	1.1	2.1	2.6	2.9	3.4	3.3	3.4	3.1	2.4	1.9	2.0	1.9	1.6	1.4	1.0	****	****	0.8	1.8

PERCENTAGE OF DATA VALID 88.6

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 1158.00 TOTAL MONTHLY RECORD HOURS = 659.00

TABLE: F-144

OWMC AIR POLLUTION SURVEY

NITROGEN DIOXIDE

UNITS PPB

STATION LINCOLN COUNTY

MONTH JUN 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	6	5	5	4	8	6	7	5	4	4	3	3	3	4	8	5	4	7	2	3	0	5	4	8	4.7
2	4	2	2	1	0	2	3	2	1	1	1	1	7	6	7	6	6	6	7	10	13	13	9	8	4.9
3	8	9	8	7	7	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
4	****	****	****	****	****	****	****	****	****	9	11	10	4	1	0	0	0	5	25	2	4	3	****	7	5.8
5	3	3	3	3	2	0	0	****	****	****	****	****	****	4	3	2	2	1	1	4	4	5	7	****	2.8
6	3	3	2	2	1	1	5	6	****	****	****	****	****	****	****	****	****	****	****	****	****	10	10	10	****
7	9	9	9	6	7	5	5	5	5	4	5	7	7	7	6	6	6	6	9	8	8	7	7	6	6.6
8	7	5	6	3	2	2	2	2	2	2	3	3	2	1	0	1	0	0	0	0	1	0	1	2	2.0
9	4	3	3	5	4	2	3	3	2	2	****	****	****	****	****	****	****	1	2	2	8	8	8	8	4.0
10	9	7	5	4	10	16	17	15	10	5	2	2	1	0	0	1	2	2	3	5	6	7	8	9	6.1
11	9	8	8	7	5	4	4	12	12	12	10	11	11	3	4	6	6	5	6	7	10	10	8	17	8.1
12	13	10	8	8	7	8	8	8	8	10	10	8	4	2	8	2	6	2	1	3	6	5	8	7	6.7
13	4	6	8	7	1	0	0	0	0	0	0	0	0	0	2	8	5	4	6	0	0	1	2	7	2.5
14	8	11	11	9	9	8	5	3	2	2	3	1	1	0	0	0	0	0	0	2	2	1	1	****	3.4
15	****	****	3	5	2	2	4	3	3	2	1	2	1	1	0	0	0	0	1	2	1	2	9	7	2.3
16	****	****	1	0	0	1	1	0	0	1	2	2	2	2	2	****	****	****	3	1	2	2	3	****	1.4
17	****	2	1	1	1	1	7	6	3	1	1	1	2	1	1	2	1	0	0	1	3	2	2	2	1.8
18	****	****	****	1	6	2	2	2	2	2	6	2	2	2	5	6	3	3	2	3	4	5	****	****	3.2
19	7	10	6	7	8	9	10	9	9	15	18	13	20	12	14	9	8	10	11	11	9	8	****	****	10.6
20	7	7	6	7	8	8	10	9	7	4	4	5	5	4	4	3	3	1	1	3	6	9	****	****	5.5
21	DATA MISSING																								
22	DATA MISSING																								
23	****	****	****	****	****	****	****	****	****	****	****	****	****	3	3	4	6	5	5	5	6	6	****	****	****
24	3	8	8	8	8	8	6	4	3	3	3	2	2	2	2	3	3	3	4	7	5	4	****	****	4.5
25	0	0	0	0	0	0	0	0	0	0	0	0	****	****	****	3	13	13	13	12	12	12	12	****	4.5
26	8	8	8	7	7	8	8	6	6	****	****	****	****	****	****	10	****	****	****	****	****	****	****	****	****
27	****	****	****	****	****	****	****	****	****	****	****	****	30	11	10	11	6	5	3	4	4	7	****	****	****
28	6	6	5	6	6	5	6	6	4	3	2	2	2	3	7	7	3	2	2	3	4	5	****	****	4.3
29	6	5	6	6	8	3	1	1	0	1	0	0	0	3	1	1	0	23	4	4	6	8	****	****	4.0
30	9	7	9	6	4	4	4	5	4	3	3	4	4	2	1	2	1	1	3	13	15	12	****	****	5.3
MEAN	6.3	6.1	5.5	4.8	4.8	4.4	4.9	4.9	4.0	3.9	4.2	3.8	5.2	3.2	3.8	4.1	3.7	4.4	4.6	4.6	5.6	6.0	6.2	****	4.8

PERCENTAGE OF DATA VALID 75.3

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 2595.00 TOTAL MONTHLY RECORD HOURS = 542.00

TABLE: F-145

OWMC AIR POLLUTION SURVEY

NITROGEN DIOXIDE

UNITS PPB

STATION LINCOLN COUNTY

MONTH JUL 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	8	11	8	6	5	5	****	****	****	3	2	****	15	12	****	****	3	0	5	10	10	6	****	****	6.8
2	4	4	4	4	4	7	4	6	13	15	15	16	15	9	4	3	3	3	4	4	5	4	****	****	6.8
3	6	3	1	1	1	1	2	2	3	4	3	1	0	1	1	1	0	0	0	3	3	6	****	****	2.0
4	11	8	14	9	7	7	7	4	3	2	5	3	1	1	1	11	3	2	2	2	2	2	****	****	4.9
5	3	3	4	4	4	4	4	5	5	6	6	6	7	6	9	7	10	7	1	7	9	9	****	****	5.7
6	6	6	4	3	5	5	4	6	7	10	10	12	14	8	14	7	4	3	10	7	5	6	****	****	7.1
7	6	5	5	7	8	10	10	7	7	7	7	7	9	7	7	7	11	11	12	7	8	10	****	****	8.0
8	6	9	12	10	10	8	8	7	5	7	7	4	5	4	4	8	12	15	30	8	6	9	****	****	8.8
9	4	5	5	5	8	11	11	9	7	9	10	19	14	4	4	2	0	0	3	1	2	6	****	****	6.3
10	6	3	4	4	4	3	4	7	1	2	3	0	0	0	0	1	0	1	0	1	2	7	****	****	2.4
11	8	10	10	14	18	22	****	****	12	12	11	6	6	5	8	5	4	2	2	3	5	10	****	****	8.6
12	15	13	13	9	6	6	6	6	6	5	5	5	3	3	2	1	2	3	4	4	7	6	****	****	5.9
13	11	7	6	5	5	3	4	3	4	3	4	1	3	3	4	4	1	0	0	4	5	6	****	****	3.9
14	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	1	1	4	2	****	****	0.8
15	4	4	5	4	3	4	3	2	2	3	1	0	0	0	0	4	5	8	2	0	2	5	****	****	2.8
16	4	4	4	5	6	7	5	5	3	7	9	6	4	4	4	3	1	6	18	17	6	4	****	****	6.0
17	5	4	4	5	4	5	6	4	5	6	11	7	9	4	2	2	2	4	6	7	20	10	****	****	6.0
18	5	4	1	1	2	2	2	2	3	2	2	1	2	3	2	2	1	6	4	7	4	4	****	****	2.8
19	4	4	4	3	3	2	1	2	1	1	2	1	2	3	3	1	1	0	1	3	2	2	****	****	2.1
20	2	3	2	0	0	2	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	****	****	0.6
21	4	4	4	4	2	2	0	0	0	0	1	1	0	0	0	3	4	4	3	3	4	8	****	****	2.3
22	5	4	6	5	5	6	7	8	11	5	5	4	2	1	6	****	1	0	1	2	2	5	****	****	4.3
23	2	3	3	2	3	2	1	2	2	5	8	6	2	1	1	0	0	0	0	0	1	2	****	****	2.1
24	11	16	10	12	12	12	10	6	7	3	5	2	2	3	3	2	0	0	0	1	2	2	****	****	5.5
25	4	3	2	4	3	2	2	1	1	1	6	2	1	0	0	0	30	15	4	2	2	2	****	****	4.0
26	0	1	1	1	1	0	1	2	2	0	0	0	0	0	0	1	1	0	0	0	0	0	****	****	0.5
27	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	5	****	****	0.5
28	6	10	9	7	6	8	6	3	1	0	0	0	0	0	0	0	0	0	0	0	0	1	****	****	2.6
29	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.1
30	0	0	0	0	0	0	1	1	1	4	7	6	3	1	4	1	0	1	2	3	2	4	****	****	1.9
31	3	2	2	4	4	3	2	4	0	0	1	0	16	3	****	0	1	2	0	1	1	8	****	****	2.7
MEAN	5.1	5.0	4.8	4.5	4.5	4.8	3.9	3.6	3.7	3.9	4.7	3.9	4.4	2.8	2.9	2.7	3.2	3.1	3.7	3.5	4.0	4.9	****	****	4.0

PERCENTAGE OF DATA VALID 90.3

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 2679.00 TOTAL MONTHLY RECORD HOURS = 672.00

TABLE: F-146

OWMC AIR POLLUTION SURVEY

NITROGEN DIOXIDE

UNITS PPB

STATION LINCOLN COUNTY

MONTH AUG 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	3	0	0	2	1	1	2	1	0	1	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
2											DATA MISSING														
3											DATA MISSING														
4											DATA MISSING														
5											DATA MISSING														
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	7	7	6	****	****	1.1
7	9	7	****	0	0	0	0	0	0	0	0	0	0	0	0	0	9	9	9	9	9	9	****	****	3.3
8	0	0	0	****	****	0	0	0	0	0	0	0	0	7	0	5	3	8	2	0	0	0	****	****	1.3
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	****	****	0.2
12	3	2	3	3	3	3	2	2	1	1	1	0	1	0	3	1	2	1	2	2	3	4	****	****	2.0
13	6	6	4	5	6	5	5	6	4	5	1	9	7	5	4	3	2	3	4	4	9	13	****	****	5.3
14	15	17	17	15	9	5	5	6	8	7	3	3	4	5	4	3	2	3	3	4	4	4	****	****	6.6
15	4	2	2	2	3	4	4	5	5	5	6	5	4	3	2	1	0	33	33	3	5	7	****	****	6.3
16	5	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	1	3	0	0	0	0	****	****	0.5
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	10	4	****	****	1.0
18	7	4	2	2	0	0	0	2	2	4	0	0	0	0	0	0	0	0	0	1	****	5	****	****	1.4
19	7	2	3	3	1	1	0	0	****	****	****	****	****	****	****	****	****	8	7	9	7	12	****	****	4.6
20											DATA MISSING														
21											DATA MISSING														
22											DATA MISSING														
23											DATA MISSING														
24											DATA MISSING														
25	****	****	****	****	****	****	****	****	****	****	****	****	3	2	3	2	3	3	2	4	5	4	****	****	****
26	9	10	8	6	5	4	6	8	8	8	7	6	6	7	6	0	0	0	0	0	0	0	****	****	4.7
27	4	3	3	3	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	1	0	****	****	0.9
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
29	3	5	4	2	1	1	2	3	3	2	1	0	0	0	0	1	1	0	0	1	3	3	****	****	1.6
30	6	5	14	17	14	16	11	10	11	11	8	9	10	8	4	3	3	3	3	5	5	6	****	****	8.3
31	18	13	13	12	12	11	11	13	9	8	6	5	3	2	2	1	2	6	6	7	9	14	****	****	8.3
MEAN	4.7	3.6	3.7	3.6	2.8	2.4	2.3	2.7	2.6	2.6	1.7	1.9	1.9	2.0	1.5	1.1	1.5	3.9	3.4	3.1	4.0	4.4	****	****	2.8

PERCENTAGE OF DATA VALID 60.1

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 1255.00 TOTAL MONTHLY RECORD HOURS = 447.00

TABLE: F-147

OWMC AIR POLLUTION SURVEY

NITROGEN DIOXIDE

UNITS PPB

STATION LINCOLN COUNTY

MONTH SEP 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	10	11	15	11	12	14	11	9	7	7	6	3	3	3	2	2	2	2	2	3	10	16	****	****	7.4
2	14	12	13	9	7	7	8	6	20	14	12	9	6	5	5	4	6	8	9	10	13	12	****	****	9.5
3	17	17	16	14	11	11	17	20	21	14	8	5	3	2	5	6	6	7	8	4	3	2	****	****	9.9
4	3	3	3	2	3	4	2	2	3	3	5	5	4	2	3	3	3	5	5	5	4	4	****	****	3.5
5	5	3	2	1	2	2	2	4	2	0	0	0	0	0	0	2	6	6	4	5	4	5	****	****	2.5
6	5	10	9	3	4	9	7	6	4	6	5	1	1	1	1	0	2	1	2	3	6	9	****	****	4.3
7	3	4	5	4	4	5	5	5	7	2	2	1	1	1	1	1	1	1	2	4	5	4	****	****	3.1
8	6	6	8	7	7	7	7	7	7	7	6	5	5	6	5	4	3	4	5	3	3	6	****	****	5.6
9	5	5	5	6	5	5	5	5	8	8	10	5	7	8	4	4	4	4	4	6	8	14	****	****	6.1
10	16	11	12	9	8	7	9	9	6	9	13	9	10	20	25	20	23	12	10	15	9	3	****	****	12.0
11	3	3	2	2	3	3	2	1	1	1	2	2	2	1	2	2	3	2	1	1	0	1	****	****	1.8
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	5	1	****	****	0.4
13	2	3	2	2	2	2	2	3	2	2	2	2	3	3	3	1	0	0	1	2	3	4	****	****	2.1
14	5	7	7	7	6	5	4	5	5	4	3	2	1	0	3	1	2	1	1	2	2	3	****	****	3.5
15	18	10	8	3	5	4	4	5	6	6	6	6	7	11	30	24	14	13	15	11	15	12	****	****	10.6
16	5	5	7	8	4	4	4	9	17	16	10	14	10	9	6	6	6	7	9	11	12	12	****	****	8.7
17											DATA MISSING														
18	****	****	****	****	****	****	****	****	****	****	****	****	****	18	15	15	13	11	12	12	11	11	****	****	****
19	9	8	9	14	18	27	22	13	11	7	2	5	15	6	3	1	2	5	8	11	12	13	****	****	10.0
20	15	8	3	5	23	15	0	0	0	5	5	3	3	0	0	0	0	3	3	3	3	5	****	****	4.6
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	5	3	****	****	0.5
22	13	13	10	8	5	8	5	8	10	8	8	3	5	****	****	****	10	5	5	5	8	28	****	****	8.7
23	3	3	3	5	3	3	0	0	0	3	0	0	0	0	****	****	****	0	0	0	0	0	****	****	1.2
24	5	8	5	5	3	3	3	5	3	3	3	3	0	0	3	3	3	3	3	3	3	5	****	****	3.4
25	5	10	10	18	10	13	15	15	15	13	13	8	10	30	18	23	13	****	20	18	20	23	****	****	15.2
26	28	30	25	25	18	20	13	13	8	13	10	10	10	10	8	8	8	8	8	8	8	15	****	****	13.8
27	10	8	5	3	5	3	0	0	0	3	5	5	8	8	8	10	10	10	13	18	23	15	****	****	7.7
28	10	5	5	3	3	3	3	0	3	3	0	3	3	3	5	5	10	10	10	10	10	8	****	****	5.2
29	5	5	5	5	8	8	8	3	3	3	3	0	0	****	****	****	****	0	0	0	0	0	****	****	3.1
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
MEAN	7.9	7.4	6.9	6.4	6.4	6.9	5.6	5.5	6.0	5.7	5.0	4.0	4.2	5.4	6.0	5.6	5.6	4.6	5.6	6.1	7.1	8.1	****	****	6.0

PERCENTAGE OF DATA VALID 85.3

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 3682.00 TOTAL MONTHLY RECORD HOURS = 614.00

TABLE: F-148

OWMC AIR POLLUTION SURVEY

NITROGEN DIOXIDE

UNITS PPB

STATION LINCOLN COUNTY

MONTH OCT 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1											DATA MISSING														
2											DATA MISSING														
3											DATA MISSING														
4											DATA MISSING														
5											DATA MISSING														
6											DATA MISSING														
7	4	3	3	2	2	3	3	4	5	5	5	11	10	5	3	2	3	4	4	3	****	****	****	****	4.2
8	6	5	5	7	9	8	7	10	12	12	13	12	14	14	13	15	15	16	13	11	10	9	****	****	10.7
9	7	10	8	6	6	6	3	6	7	4	3	1	1	2	2	****	****	****	****	****	****	****	****	****	4.8
10	8	9	4	3	3	5	4	6	8	6	4	3	4	4	4	5	7	9	13	14	18	19	****	****	7.3
11	29	25	19	21	21	20	17	14	9	6	5	4	5	8	9	8	6	7	9	11	20	16	****	****	13.1
12	9	7	8	7	7	8	10	34	10	9	11	9	8	10	11	8	8	8	12	12	10	4	****	****	10.0
13	9	7	7	8	9	10	9	8	9	9	7	6	7	3	3	1	5	6	8	7	7	7	****	****	6.9
14	13	20	17	13	14	14	14	11	14	11	9	9	8	9	4	16	12	6	6	7	8	7	****	****	11.0
15	7	7	5	4	3	3	2	3	3	5	3	3	3	4	8	10	9	9	9	9	10	7	****	****	5.7
16	14	10	8	7	7	7	7	8	10	9	10	7	5	4	5	6	6	7	9	10	9	9	****	****	7.9
17	24	28	24	21	20	28	27	26	20	17	19	12	9	7	5	5	6	6	7	6	5	5	****	****	14.9
18	4	2	3	14	12	29	27	30	27	20	15	8	9	8	7	7	7	8	10	7	13	16	****	****	12.9
19	20	15	15	13	14	15	15	13	14	17	16	12	11	11	10	11	12	14	10	10	11	11	****	****	13.2
20	11	10	10	9	11	11	11	14	19	17	20	18	16	11	12	11	8	9	11	7	7	10	****	****	12.0
21	10	7	4	6	10	20	18	13	12	12	12	9	10	14	11	9	9	15	17	14	15	14	****	****	11.9
22	7	8	10	16	18	17	16	16	14	9	10	13	13	16	14	15	24	29	24	15	12	11	****	****	14.9
23	8	8	6	6	6	6	7	8	9	7	7	7	6	8	8	17	14	17	21	25	25	27	****	****	11.5
24	21	20	24	19	13	12	13	14	12	10	6	6	5	3	3	3	5	7	12	14	18	29	****	****	12.2
25	21	19	17	16	15	15	15	19	16	21	21	22	26	28	31	34	32	23	18	22	35	35	****	****	22.8
26	23	21	19	13	11	11	10	10	16	19	17	13	14	15	15	13	16	19	22	26	27	25	****	****	17.0
27	22	19	20	18	16	17	17	15	13	13	13	15	13	9	8	9	8	10	8	9	10	9	****	****	13.2
28	4	5	3	4	3	4	3	4	7	7	6	5	5	11	12	17	8	9	6	7	9	12	****	****	6.9
29	11	10	10	10	9	8	8	9	8	9	8	8	13	12	13	11	13	13	13	6	6	6	****	****	9.7
30	7	9	3	2	2	3	3	4	4	4	8	12	8	8	9	9	12	18	20	21	25	22	****	****	9.7
31	26	28	35	34	33	31	21	18	12	9	5	5	5	5	7	6	8	18	18	9	10	9	****	****	16.0
MEAN	13.0	12.5	11.5	11.2	11.0	12.4	11.5	12.7	11.6	10.7	10.1	9.2	9.1	9.2	9.1	10.3	10.5	12.0	12.5	11.8	13.9	13.9	****	****	11.3

PERCENTAGE OF DATA VALID 72.7

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 6125.00 TOTAL MONTHLY RECORD HOURS = 541.00

TABLE: F-149

OWMC AIR POLLUTION SURVEY

NITROGEN DIOXIDE

UNITS PPB

STATION LINCOLN COUNTY

MONTH NOV 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	12	11	11	11	12	13	14	17	17	18	16	15	14	13	13	13	17	15	17	11	8	5	****	****	13.3
2	7	6	3	3	3	3	4	5	4	3	3	2	3	2	2	2	3	5	7	10	15	17	****	****	5.1
3	18	19	16	16	18	13	14	13	13	11	11	11	8	7	8	9	13	6	7	16	12	7	****	****	12.1
4	14	14	16	16	16	6	6	10	10	8	8	10	7	6	7	10	13	15	18	20	23	22	****	****	12.5
5	23	24	18	22	14	14	12	15	19	19	20	****	****	****	****	****	****	****	****	****	****	****	****	****	****
6											DATA MISSING														
7	****	****	****	****	****	****	****	****	****	****	****	****	52	49	42	44	41	38	37	36	34	32	****	****	****
8	25	24	22	21	19	17	19	18	15	14	17	17	17	16	12	9	7	8	10	8	6	6	****	****	14.9
9	6	5	5	4	4	2	3	5	6	5	3	3	6	4	4	4	3	3	2	2	1	1	****	****	3.7
10	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	2	3	8	10	11	12	13	****	****	2.9
11	22	17	14	9	5	5	5	6	6	8	12	9	8	4	7	10	8	10	8	7	5	3	****	****	8.5
12	6	5	4	4	3	4	5	6	8	19	18	13	19	14	10	****	****	13	14	11	13	13	****	****	10.1
13	4	3	2	1	0	0	0	2	4	7	2	4	2	0	1	1	1	2	1	1	2	4	****	****	2.0
14	4	3	1	1	2	1	2	3	2	4	7	16	6	9	9	11	9	9	10	11	13	14	****	****	6.7
15	27	27	25	12	9	8	7	8	13	36	16	20	36	23	20	20	20	21	18	15	14	15	****	****	18.6
16	15	21	28	28	25	19	15	13	13	14	14	15	15	15	16	14	16	18	3	18	15	14	****	****	16.5
17	13	11	11	10	9	9	13	15	23	13	16	16	19	20	16	21	18	23	26	22	19	17	****	****	16.4
18	21	22	22	21	21	23	21	21	19	19	12	10	9	10	14	9	7	9	6	4	3	6	****	****	14.0
19	14	7	4	3	3	2	2	8	7	7	3	1	1	1	****	****	9	13	17	15	24	23	****	****	8.2
20	24	19	22	18	12	14	17	16	13	16	13	17	33	25	16	17	****	****	48	47	40	30	****	****	22.9
21	40	31	23	16	12	8	9	11	10	9	6	8	10	6	7	9	9	11	6	17	16	17	****	****	13.2
22	17	16	16	18	15	14	15	14	11	13	12	14	11	10	8	6	12	15	19	22	22	22	****	****	14.6
23	18	23	25	35	39	17	12	12	12	12	12	10	12	13	14	17	24	24	18	12	12	12	****	****	17.5
24	16	17	18	12	6	6	8	8	7	5	6	5	5	6	7	5	8	****	****	****	6	6	****	****	8.3
25	10	10	10	13	13	13	13	13	13	13	12	11	10	15	16	16	21	24	27	28	30	30	****	****	16.4
26	32	41	54	45	41	36	32	34	35	38	34	24	19	19	17	24	23	26	34	32	33	24	****	****	31.7
27	23	22	19	16	13	12	13	11	11	10	9	8	****	****	10	20	14	7	8	10	14	13	****	****	13.1
28	9	16	6	7	9	10	13	20	24	23	10	10	****	****	****	****	16	23	18	19	20	20	****	****	15.2
29	24	15	11	11	15	19	19	18	16	16	15	10	10	12	10	14	15	16	12	9	17	29	****	****	15.1
30	15	11	15	10	10	10	8	6	4	4	4	4	4	4	4	4	****	****	****	****	****	****	****	****	7.3
MEAN	16.4	15.7	15.0	13.7	12.4	10.6	10.8	11.7	12.0	13.0	11.1	10.5	13.0	11.7	11.2	12.4	13.2	14.5	15.4	15.9	15.9	15.4	****	****	13.2

PERCENTAGE OF DATA VALID 82.5

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 7866.00 TOTAL MONTHLY RECORD HOURS = 594.00

TABLE: F-150

OWMC AIR POLLUTION SURVEY

NITROGEN DIOXIDE

UNITS PPB

STATION LINCOLN COUNTY

MONTH DEC 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	10	8	5	5	4	4	5	8	7	7	7	8	****	****	12	16	18	19	21	19	21	22	****	****	11.3
2	19	17	19	15	14	15	19	17	19	23	23	35	35	31	33	38	39	34	23	23	21	23	****	****	24.3
3	21	19	21	21	21	23	21	23	22	26	26	26	27	23	15	13	****	****	****	9	10	6	****	****	19.6
4	7	5	6	6	5	5	6	6	5	6	6	5	5	5	6	7	5	6	9	10	10	11	****	****	6.5
5	5	4	4	4	5	5	6	6	7	6	6	6	7	0	9	10	10	9	6	10	9	8	****	****	6.5
6	11	10	10	8	10	12	13	17	15	14	17	20	17	18	19	20	22	24	24	25	25	25	****	****	17.1
7	20	19	18	20	23	27	29	22	18	21	22	19	24	21	21	26	19	21	23	26	27	27	****	****	22.4
8	24	22	16	12	8	6	5	5	11	7	6	8	8	9	11	11	13	****	12	12	15	****	****	19	11.4
9	17	17	19	20	21	20	21	23	25	26	26	27	26	30	32	31	32	40	42	38	32	****	****	20	26.6
10	14	13	19	18	15	15	12	9	8	7	6	7	6	8	9	****	10	10	10	12	14	****	****	19	11.5
11	17	15	16	17	18	18	17	18	20	15	10	10	9	10	9	13	25	29	26	27	29	****	****	27	18.0
12	30	22	12	12	11	11	12	11	9	9	7	5	6	6	5	6	8	6	6	6	6	****	****	7	9.7
13	8	6	5	6	7	13	11	10	8	6	10	7	6	6	5	5	4	4	7	8	8	****	****	9	7.2
14	11	7	8	8	9	9	13	19	17	17	20	17	12	13	14	25	13	15	15	14	12	****	****	16	13.8
15	15	15	14	14	13	13	13	14	13	11	11	12	26	12	****	****	****	****	18	16	14	****	****	19	14.6
16	17	16	21	25	24	25	25	27	24	24	25	23	24	25	28	27	29	32	33	35	34	****	****	33	26.2
17	31	32	34	30	29	31	32	31	32	30	28	27	31	36	31	26	****	****	****	****	****	****	****	****	30.7
18											DATA MISSING														
19											DATA MISSING														
20											DATA MISSING														
21											DATA MISSING														
22	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	13	****
23	12	11	12	21	15	14	15	20	20	19	17	18	18	22	26	27	28	25	24	22	21	****	****	22	19.5
24	22	22	20	16	22	27	26	17	16	15	16	17	21	18	19	20	20	21	23	23	22	****	****	21	20.2
25	****	****	****	19	20	19	18	17	18	16	14	13	11	10	9	9	9	9	9	10	10	****	****	10	13.2
26	10	9	9	8	8	8	8	7	7	7	8	8	8	9	10	11	12	12	13	14	15	****	****	16	9.9
27	16	14	14	13	12	12	12	12	12	14	15	16	18	16	16	14	13	16	16	19	16	****	****	18	14.7
28	18	15	14	13	12	12	11	10	10	12	15	14	14	13	14	26	32	24	20	25	29	****	****	18	16.9
29	17	17	17	18	19	20	22	22	20	19	20	18	18	18	18	19	23	22	29	28	27	****	****	31	21.0
30	31	30	28	27	32	33	29	30	29	26	20	17	19	30	34	23	18	17	19	36	36	****	****	18	26.5
31	15	13	11	10	10	10	10	11	12	13	13	12	14	12	12	16	17	18	19	18	17	****	****	16	13.6
MEAN	16.7	15.1	14.9	14.8	14.9	15.7	15.8	15.8	15.5	15.2	15.2	15.2	16.4	16.0	16.7	18.3	18.2	18.8	18.6	19.4	19.2	****	****	18.5	16.5

PERCENTAGE OF DATA VALID 74.3

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 9145.00 TOTAL MONTHLY RECORD HOURS = 553.00

TABLE: F-151

OWMC AIR POLLUTION SURVEY

NITROGEN DIOXIDE

UNITS PPB

STATION LINCOLN COUNTY

MONTH JAN 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	12	11	12	12	12	15	23	14	12	13	16	15	12	11	12	19	22	21	19	20	23	****	****	21	15.8
2	23	20	20	12	12	11	10	9	9	8	6	6	6	7	10	12	17	18	18	16	14	****	****	13	12.6
3	26	16	12	10	7	6	8	7	5	5	7	7	5	5	8	9	10	11	14	12	14	****	****	14	9.9
4	15	19	20	19	18	15	16	15	12	14	14	13	15	15	15	17	25	29	37	44	41	****	****	39	21.2
5	36	30	32	31	31	30	32	33	29	30	30	28	22	19	18	17	17	19	25	29	30	****	****	31	27.2
6	33	40	40	37	30	27	24	24	25	26	25	23	26	26	31	38	38	48	44	39	44	****	****	39	33.0
7	40	37	30	22	21	20	18	20	22	24	21	17	17	14	13	15	13	15	12	10	9	****	****	9	19.0
8	8	7	8	7	9	10	9	7	6	6	6	5	6	8	9	10	12	14	13	11	13	****	****	11	8.9
9	11	11	10	11	11	9	9	10	11	10	9	9	10	13	20	14	14	13	13	15	25	****	****	34	13.3
10	31	23	18	21	23	23	25	26	24	25	25	22	22	22	19	19	21	22	21	22	24	****	****	25	22.9
11	23	28	28	29	30	26	20	14	10	8	7	7	6	6	5	5	6	6	7	9	10	****	****	15	13.9
12	12	11	12	12	12	13	13	12	11	11	10	10	12	11	11	12	10	13	12	13	9	****	****	8	11.4
13	7	7	6	6	5	5	6	7	7	8	6	5	6	6	6	7	12	14	14	15	16	****	****	38	9.5
14	24	19	20	24	34	32	30	37	27	22	22	17	18	22	30	23	25	28	27	41	34	****	****	33	26.8
15	32	28	27	25	30	27	26	24	23	22	20	21	22	15	10	9	9	10	10	11	13	****	****	8	19.2
16	8	7	7	7	5	5	6	8	7	7	6	5	6	7	8	9	13	14	11	12	16	****	****	16	8.6
17	19	16	11	10	13	11	12	10	5	6	18	11	14	14	11	10	11	13	11	12	18	****	****	28	12.9
18	27	26	23	22	17	17	16	16	17	18	19	19	21	18	17	14	13	13	14	15	14	****	****	15	17.8
19	14	14	14	12	12	13	16	20	21	16	10	8	8	8	10	8	9	11	7	5	5	****	****	8	11.3
20	12	20	18	8	9	12	11	10	9	8	6	7	7	6	14	9	7	6	7	7	10	****	****	13	9.8
21	14	14	11	10	11	11	8	13	14	11	8	8	7	8	15	11	15	21	10	6	9	****	****	9	11.1
22	8	8	8	13	13	8	9	9	11	10	10	11	11	11	12	15	19	20	21	26	32	****	****	28	14.2
23	21	28	31	35	25	4	5	4	4	4	3	3	3	3	3	4	4	5	6	6	5	****	****	6	9.6
24	6	4	5	6	4	7	10	9	6	5	3	3	3	3	3	3	5	9	9	5	7	****	****	15	5.9
25	14	10	9	9	9	8	8	7	5	6	5	4	5	5	5	7	11	9	10	17	21	****	****	****	8.8
26	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	14	18	17	****	****	****	****	45	****
27	****	****	****	****	****	****	****	****	****	****	****	32	28	27	25	20	19	24	20	18	19	****	****	17	****
28	17	20	30	33	34	33	28	34	27	24	25	19	18	19	21	****	****	45	42	46	48	****	****	22	29.3
29	19	13	11	12	14	14	16	18	18	19	18	16	15	14	19	24	****	****	57	47	37	****	****	37	21.9
30	34	29	36	19	14	15	14	15	18	19	16	15	16	17	19	21	27	40	28	23	20	****	****	13	21.3
31	13	13	13	14	11	11	10	11	9	8	7	7	7	7	9	10	10	9	10	11	10	****	****	11	10.0
MEAN	19.3	18.2	18.0	16.8	16.4	15.1	15.1	15.3	13.9	13.6	13.0	12.4	12.5	12.2	13.6	13.5	14.8	17.9	18.3	18.8	19.7	****	****	20.7	15.9

PERCENTAGE OF DATA VALID 87.1

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 10287.00 TOTAL MONTHLY RECORD HOURS = 648.00

TABLE: F-152

OWMC AIR POLLUTION SURVEY

NITROGEN DIOXIDE

UNITS PPB

STATION LINCOLN COUNTY

MONTH FEB 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	14	12	13	14	15	13	11	10	9	8	11	10	10	14	15	15	17	23	22	20	20	****	****	24	14.5
2	21	19	19	21	24	30	21	21	18	16	16	15	14	16	17	22	22	24	23	26	19	****	****	16	20.0
3	16	34	37	27	25	20	20	22	23	22	19	19	22	19	16	13	10	10	15	11	****	****	****	8	19.4
4	9	8	8	9	8	8	9	10	10	8	10	11	10	10	9	9	11	13	12	10	12	****	****	8	9.6
5	9	11	11	12	11	10	8	10	9	7	5	5	14	9	9	18	6	7	14	23	29	****	****	21	11.7
6	21	22	21	21	21	26	28	29	22	19	18	18	23	21	18	18	24	48	44	42	38	****	****	27	25.9
7	25	21	20	20	19	19	15	14	12	12	12	11	11	10	11	12	14	15	17	17	16	****	****	19	15.5
8	19	18	17	16	17	18	22	21	20	18	16	13	10	9	10	10	14	13	12	11	13	****	****	12	15.0
9	9	7	7	6	6	8	10	11	11	18	18	13	7	10	7	6	7	9	10	12	14	****	****	42	11.3
10	42	38	26	15	15	14	13	15	14	11	****	****	****	****	****	****	****	13	15	20	19	****	****	19	19.3
11	17	18	16	15	13	12	13	15	19	16	17	20	15	17	18	20	18	15	17	18	24	****	****	20	17.0
12	28	38	49	44	50	47	33	28	24	21	16	14	11	9	9	9	24	31	26	17	22	****	****	6	25.3
13	5	5	3	3	2	2	2	4	5	5	6	7	6	6	7	8	7	13	17	24	22	****	****	31	8.6
14	29	27	14	6	3	4	9	9	6	4	5	4	5	3	3	3	5	6	11	22	16	****	****	6	9.1
15	4	2	2	1	1	1	3	3	3	3	2	2	5	4	2	2	6	6	8	8	12	****	****	2	3.7
16	2	2	2	3	3	4	4	8	8	7	4	3	3	3	3	5	9	12	16	14	10	****	****	12	6.2
17	10	12	12	25	21	22	16	13	12	8	5	5	4	5	5	6	6	8	9	14	16	****	****	24	11.7
18	26	23	22	23	15	11	8	10	10	8	4	4	4	5	5	9	20	39	45	39	30	****	****	31	17.8
19	22	17	13	13	12	10	13	13	11	13	9	6	10	14	21	18	13	10	13	13	11	****	****	19	13.4
20	21	23	35	39	32	30	34	27	22	20	16	10	12	15	16	15	14	13	15	16	16	****	****	23	21.1
21	22	24	20	21	19	18	17	16	18	15	13	11	10	9	7	7	6	26	32	30	30	****	****	31	18.3
22	33	37	40	38	37	36	35	37	32	24	22	18	21	18	12	19	25	27	15	18	19	****	****	15	26.3
23	13	10	10	11	10	10	21	20	24	35	31	39	32	20	11	****	****	****	10	10	10	****	****	11	17.8
24	10	8	7	7	8	8	9	13	15	10	8	8	10	9	14	12	10	10	11	13	17	****	****	18	10.7
25	12	15	14	12	12	14	19	18	18	18	18	18	13	14	15	17	17	18	23	22	32	****	****	34	17.9
26	44	37	38	47	40	43	38	31	21	20	17	10	8	8	10	18	18	22	22	23	23	****	****	23	25.5
27	22	22	20	20	20	33	39	34	27	14	15	18	16	12	11	12	15	18	22	22	25	****	****	34	21.4
28	34	31	30	34	34	15	11	12	12	20	33	21	15	19	32	33	27	29	34	36	31	****	****	13	25.3
MEAN	19.3	19.3	18.8	18.7	17.6	17.4	17.2	16.9	15.5	14.3	13.6	12.3	11.9	11.4	11.6	12.9	14.0	17.7	18.9	19.7	20.2	****	****	19.6	16.4

PERCENTAGE OF DATA VALID 90.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 9894.00 TOTAL MONTHLY RECORD HOURS = 605.00

TABLE: F-153

OWMC AIR POLLUTION SURVEY

NITROGEN DIOXIDE

UNITS PPB

STATION LINCOLN COUNTY

MONTH MAR 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	21	22	22	20	20	21	20	18	18	20	18	17	18	19	20	17	15	19	22	28	22	****	****	20	19.9
2	18	21	18	15	13	13	11	8	8	8	7	7	7	7	6	6	6	6	6	6	7	****	****	8	9.6
3	7	7	7	8	7	7	7	6	6	2	****	****	****	****	****	****	****	****	****	12	****	****	****	7	6.9
4	6	6	8	10	9	12	13	12	9	11	7	5	****	****	11	9	7	8	7	7	7	****	****	7	8.6
5	6	5	5	6	7	7	7	7	8	7	6	6	6	****	****	10	14	15	19	15	19	****	****	24	9.9
6	22	23	23	24	22	21	22	20	17	18	20	21	22	25	26	36	40	41	43	39	33	****	****	24	26.5
7	25	23	18	21	21	28	27	24	25	22	17	15	16	20	21	19	20	32	19	32	19	****	****	16	21.8
8	14	13	12	11	11	11	11	10	10	11	17	20	16	17	20	26	20	20	23	23	20	****	****	28	16.5
9	25	20	12	9	7	7	7	8	7	6	6	6	6	4	4	4	3	3	4	3	3	****	****	3	7.1
10	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	4	6	8	8	12	12	****	****	7	4.4
11	12	18	19	28	30	31	27	17	17	11	9	8	8	8	8	9	13	18	22	14	13	****	****	13	16.0
12	13	14	14	15	19	22	31	35	31	22	17	14	19	15	11	11	13	13	11	11	11	****	****	15	17.1
13	19	22	22	19	17	17	20	15	12	11	11	11	12	7	7	8	8	8	9	9	9	****	****	14	13.0
14	12	12	19	14	14	15	19	19	13	11	9	8	8	8	8	9	12	12	12	12	11	****	****	9	12.1
15	9	11	9	8	8	8	8	9	8	7	7	7	6	6	6	7	6	7	8	13	20	****	****	28	9.4
16	23	17	17	15	14	13	14	17	11	11	6	7	6	6	7	7	9	20	24	20	15	****	****	15	13.4
17	20	24	22	19	18	20	17	18	17	19	18	18	14	12	8	8	14	24	19	25	18	****	****	17	17.7
18	19	25	29	24	23	20	23	20	18	11	9	11	11	8	7	6	7	8	12	14	17	****	****	28	15.9
19	57	35	38	54	56	51	45	25	23	25	19	11	13	15	13	11	8	13	18	27	33	****	****	31	28.2
20	23	24	25	18	16	13	12	12	15	21	18	15	14	12	12	15	10	11	14	14	13	****	****	13	15.5
21	13	11	9	13	26	36	30	25	23	21	17	13	11	12	12	14	15	16	18	18	17	****	****	19	17.7
22	19	21	20	18	17	15	16	23	20	16	13	12	10	9	8	9	9	11	14	21	19	****	****	27	15.8
23	26	20	17	16	15	17	21	26	22	21	16	11	24	20	63	12	10	14	15	17	19	****	****	27	20.4
24	31	31	27	27	31	38	33	26	24	18	14	11	10	16	15	16	20	23	18	18	24	****	****	30	22.8
25	14	14	12	12	11	14	12	15	20	17	16	15	15	15	14	13	15	14	15	12	11	****	****	10	13.9
26	10	9	9	10	12	12	10	10	11	10	14	17	20	11	13	14	16	14	13	14	14	****	****	15	12.6
27	16	14	14	14	14	14	13	13	13	12	12	14	12	11	11	11	10	10	22	30	37	****	****	33	15.9
28	31	31	30	28	25	20	22	21	19	16	16	12	12	11	11	13	10	11	12	13	14	****	****	17	18.0
29	21	20	20	21	20	28	28	24	21	14	16	16	16	16	17	16	16	16	20	22	50	****	****	10	20.4
30	10	12	12	12	12	11	10	10	11	11	12	11	20	25	20	14	14	19	31	26	21	****	****	7	15.0
31	6	6	7	6	6	6	6	6	7	7	8	9	7	6	5	5	6	6	6	6	6	****	****	6	6.3
MEAN	17.7	17.2	16.7	16.7	16.9	17.7	17.6	16.2	15.1	13.5	12.6	11.7	12.5	12.3	13.3	12.0	12.4	14.7	16.1	17.2	17.8	****	****	17.0	15.3

PERCENTAGE OF DATA VALID 89.8

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 10197.00 TOTAL MONTHLY RECORD HOURS = 668.00

TABLE: F-154

OWMC AIR POLLUTION SURVEY

NITROGEN DIOXIDE

UNITS PPB

STATION LINCOLN COUNTY

MONTH APR 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	6	5	5	5	5	4	5	10	12	8	7	7	6	7	8	9	9	10	13	15	16	****	****	15	8.5
2	15	13	14	13	13	10	12	10	10	8	9	7	8	8	9	****	****	10	9	9	9	****	****	8	10.2
3	8	7	6	6	6	6	6	6	5	5	4	5	4	4	4	4	4	7	11	14	21	****	****	15	7.2
4	15	11	17	14	11	9	8	7	8	9	9	9	10	10	10	10	9	9	8	7	8	****	****	8	9.8
5	7	7	8	8	8	8	8	8	9	9	9	9	9	9	8	10	12	9	10	10	11	11	****	****	9.0
6	8	8	8	8	8	8	8	9	10	10	10	9	10	9	11	12	11	11	12	9	8	8	****	****	9.3
7	38	26	29	24	19	16	15	18	21	26	28	17	18	16	17	13	14	13	17	19	15	11	****	****	19.5
8	13	13	12	11	10	10	11	14	15	19	20	18	17	14	11	8	10	14	16	11	11	****	****	16	13.4
9	12	14	14	17	16	16	15	15	14	15	16	11	10	8	9	9	9	9	8	8	8	****	****	11	12.0
10	9	9	8	8	8	8	8	13	18	18	18	19	21	17	16	13	13	14	14	11	12	****	****	23	13.5
11	24	20	16	22	17	17	15	14	13	13	12	22	29	21	16	14	13	12	9	10	10	****	****	9	15.8
12	9	11	10	11	10	12	12	14	20	33	23	18	21	20	18	12	16	19	19	18	15	****	****	8	15.9
13	9	10	9	18	22	15	17	20	20	14	10	10	9	****	****	****	****	****	****	12	11	****	****	32	14.9
14	30	22	26	25	25	20	20	21	19	14	10	9	17	19	15	15	15	17	19	19	20	****	****	23	19.1
15	21	24	27	23	18	13	15	18	21	14	12	11	12	20	23	12	10	11	12	12	10	****	****	11	15.9
16	11	10	8	7	8	9	11	13	12	11	16	26	18	14	16	16	15	16	15	12	15	****	****	9	13.1
17	8	8	9	11	13	14	17	13	13	10	10	10	10	11	11	11	10	10	10	10	10	****	****	8	10.8
18	9	10	14	15	13	10	9	7	8	11	10	8	8	8	7	6	8	8	9	9	9	****	****	13	9.5
19	8	8	9	8	8	8	9	9	8	9	10	10	14	11	9	8	6	7	7	8	9	****	****	8	8.7
20	8	8	8	6	6	10	11	15	16	16	21	28	25	17	15	14	13	12	12	12	16	****	****	19	14.0
21	23	26	28	31	20	13	12	18	17	****	****	16	18	14	13	15	13	13	13	19	17	****	****	10	17.5
22	8	6	6	6	5	6	8	8	9	8	8	7	7	8	8	8	8	8	9	11	13	****	****	12	8.0
23	14	15	14	13	10	10	10	12	13	13	11	12	22	29	20	15	17	19	19	19	19	****	****	18	15.6
24	15	13	12	12	11	8	7	6	6	7	6	5	5	5	5	5	5	6	6	7	11	****	****	17	8.2
25	15	11	8	9	11	12	10	10	9	7	5	6	7	6	5	6	6	7	9	11	14	****	****	12	8.9
26	8	7	10	13	13	11	12	13	12	10	8	8	10	6	7	6	7	6	6	9	12	****	****	13	9.4
27	18	23	18	18	14	14	20	20	13	10	11	11	11	17	18	16	22	13	15	20	18	****	****	13	16.0
28	12	12	7	6	5	4	6	5	6	5	5	5	6	6	6	6	****	****	8	7	6	****	****	6	6.4
29	6	6	7	7	8	6	12	15	14	13	9	9	12	9	6	4	4	4	****	****	5	****	****	7	8.1
30	6	5	3	3	3	4	4	5	5	6	6	4	5	3	3	****	****	5	6	4	5	****	****	6	4.6
MEAN	13.1	12.3	12.3	12.6	11.5	10.4	11.1	12.2	12.5	12.1	11.5	11.5	12.6	11.9	11.2	10.3	10.7	10.7	11.5	11.8	12.1	****	****	13.0	11.8

PERCENTAGE OF DATA VALID 89.4

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 7580.00 TOTAL MONTHLY RECORD HOURS = 644.00

TABLE: F-155 OWMC AIR POLLUTION SURVEY

NITROGEN DIOXIDE UNITS PPB

STATION LINCOLN COUNTY MONTH MAY 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	6	5	6	6	9	10	12	10	8	5	4	4	4	4	11	7	6	6	7	6	7	****	****	10	7.0
2	8	6	7	6	7	7	7	9	11	11	34	11	9	9	8	9	9	8	8	8	12	****	****	15	10.0
3	24	18	16	18	17	16	15	11	5	6	8	7	7	7	7	8	6	5	5	6	9	****	****	14	10.7
4	7	5	6	9	16	9	6	6	6	6	6	6	6	5	4	4	4	4	4	5	9	****	****	9	6.5
5	9	9	10	15	29	25	23	19	16	17	13	11	9	7	8	7	9	11	11	9	10	****	****	12	13.1
6	10	10	11	16	22	19	18	16	14	13	10	8	8	10	****	****	21	18	17	15	10	****	****	12	13.9
7	11	10	7	10	10	9	9	10	12	13	13	12	9	6	5	5	7	7	8	6	7	****	****	18	9.3
8	18	16	18	42	35	26	23	20	18	10	6	6	7	6	10	10	10	12	12	6	7	****	****	10	14.9
9	7	7	8	11	9	10	11	13	13	13	24	27	24	22	15	18	29	29	22	18	18	****	****	6	16.1
10	7	8	8	8	11	10	10	9	8	7	7	6	10	9	8	7	6	7	6	6	7	****	****	10	8.0
11	7	7	7	8	7	7	8	8	11	11	12	11	43	37	40	5	5	5	5	6	7	****	****	7	12.0
12	8	9	7	5	7	6	5	****	****	****	****	****	****	****	****	18	13	14	18	18	15	****	****	16	11.4
13	21	30	27	26	24	15	17	16	12	14	16	14	13	11	11	10	10	10	10	12	15	****	****	16	15.9
14	17	13	11	11	10	11	11	12	14	12	13	14	12	11	10	11	11	9	11	12	14	****	****	9	11.8
15	8	8	8	10	8	8	7	7	9	16	16	12	11	****	****	12	12	16	18	26	22	****	****	27	13.1
16	28	25	23	23	23	22	19	16	17	16	15	13	16	15	14	15	12	8	7	8	10	****	****	11	16.2
17	9	9	10	12	14	15	16	19	19	19	17	32	30	31	30	24	19	20	18	16	21	****	****	21	19.1
18	20	11	12	11	10	9	8	8	10	10	10	12	13	12	10	9	12	10	12	12	10	****	****	10	11.0
19	8	10	9	8	8	7	10	10	12	12	11	11	11	11	14	15	13	14	15	16	19	****	****	11	11.6
20	11	12	13	14	12	10	9	7	7	7	7	7	7	7	7	7	7	7	12	12	11	****	****	10	9.2
21	17	11	9	11	11	10	10	11	12	17	20	13	10	8	9	10	9	19	30	32	35	****	****	19	15.1
22	21	14	16	13	12	12	13	13	14	15	12	13	10	15	18	11	15	8	22	12	12	****	****	9	13.6
23	9	8	9	10	9	10	9	8	8	7	7	6	6	6	6	5	5	6	6	7	10	****	****	8	7.5
24	7	9	12	12	10	9	8	6	6	6	6	6	5	5	6	6	6	5	9	14	13	****	****	13	8.1
25	15	15	17	13	11	15	18	13	10	11	9	9	11	10	12	11	7	8	10	11	17	****	****	13	12.1
26	15	12	8	7	7	6	8	11	13	13	19	19	18	17	15	9	16	17	21	21	21	****	****	14	14.0
27	11	10	9	9	9	9	10	9	10	13	11	10	10	8	7	7	6	6	6	7	12	****	****	9	9.0
28	9	8	8	9	8	9	9	11	11	12	11	10	10	9	11	7	7	7	7	5	5	****	****	11	8.8
29	12	12	12	11	10	10	11	12	11	9	6	7	6	6	8	7	6	5	7	7	7	****	****	13	8.9
30	11	11	10	7	7	9	11	12	12	10	10	9	9	11	7	5	5	5	6	8	9	****	****	7	8.7
31	7	8	7	5	6	6	6	6	8	7	8	7	7	7	7	6	6	5	5	5	6	****	****	9	6.5
MEAN	12.2	11.2	11.0	12.1	12.5	11.5	11.5	11.3	11.2	11.3	12.0	11.1	11.7	11.1	11.4	9.5	10.0	10.0	11.5	11.4	12.5	****	****	12.2	11.4

PERCENTAGE OF DATA VALID 90.1 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 7618.00 TOTAL MONTHLY RECORD HOURS = 670.00

TABLE: F-156

OWMC AIR POLLUTION SURVEY

NOX

UNITS PPB

STATION LINCOLN COUNTY

MONTH JUN 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	5	4	4	4	5	4	5	4	4	4	4	4	4	4	4	4	5	3	3	4	4	4	4	5	4.1
2	0	0	0	0	0	0	0	0	0	0	0	0	5	5	0	0	2	2	5	7	10	10	7	7	2.5
3	3	3	0	0	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
4	****	****	****	****	****	****	****	****	****	13	16	18	9	6	5	4	2	7	25	7	7	7	****	7	9.5
5	4	5	5	4	3	****	****	****	****	****	****	****	****	3	2	1	3	0	2	6	5	7	8	****	3.9
6	3	4	3	3	2	1	5	7	****	****	****	****	****	****	****	****	****	****	****	****	****	10	10	10	****
7	9	9	9	6	7	5	6	5	6	6	9	10	9	10	9	9	8	8	11	9	9	8	7	7	8.0
8	8	5	7	4	4	4	3	3	3	3	5	4	1	1	0	1	0	0	0	0	1	0	1	2	2.5
9	3	2	2	3	1	1	2	2	6	6	****	****	****	****	****	****	****	2	3	3	8	8	8	8	4.0
10	10	6	4	5	10	17	24	20	12	8	3	3	1	1	1	3	6	7	6	7	8	9	9	10	7.9
11	10	10	10	9	9	9	11	19	19	17	13	17	13	8	8	10	9	8	9	9	11	11	10	22	11.7
12	15	11	10	10	9	10	10	10	11	13	13	11	7	7	12	5	8	3	2	5	7	7	9	10	9.0
13	6	7	9	7	2	1	1	1	1	1	1	1	1	2	9	14	8	7	7	0	0	1	2	7	4.0
14	8	11	11	9	9	7	5	5	4	4	7	3	2	2	0	0	0	0	1	3	3	2	2	****	4.3
15	****	****	5	8	5	4	5	6	5	3	3	3	2	2	0	0	0	0	2	2	2	6	12	10	3.9
16	****	****	2	1	2	2	2	1	2	2	5	5	6	6	6	****	****	****	3	1	0	0	2	****	2.7
17	****	0	0	0	0	1	3	5	1	0	1	1	1	0	0	1	0	0	0	1	1	0	0	0	0.7
18	****	****	****	1	3	0	0	0	0	1	7	3	1	2	6	6	4	4	4	4	6	6	****	****	3.1
19	5	11	5	7	7	7	8	8	10	18	20	16	22	16	14	9	8	12	14	12	9	8	****	****	11.2
20	7	7	7	7	7	7	9	8	7	5	5	5	5	5	5	4	4	4	4	4	5	10	****	****	6.0
21											DATA MISSING														
22											DATA MISSING														
23	****	****	****	****	****	****	****	****	****	****	****	****	****	6	6	10	9	7	7	7	6	7	****	****	****
24	4	8	9	10	9	10	7	5	5	5	5	4	5	5	6	6	6	5	6	9	6	5	****	****	6.4
25	3	2	0	0	0	0	0	0	0	0	0	1	****	****	****	5	4	8	7	5	10	6	14	****	3.3
26	7	7	8	7	6	7	7	6	7	****	****	****	****	****	****	12	13	16	15	12	13	14	15	****	10.1
27	5	7	7	8	5	5	6	7	7	10	11	12	30	****	****	****	****	****	****	****	****	****	****	****	9.2
28	6	7	8	6	5	6	7	5	6	5	5	22	36	16	14	15	9	7	5	5	6	8	****	****	9.5
29	6	7	6	6	6	6	7	7	5	3	2	2	3	4	9	9	4	3	3	4	5	5	****	****	5.1
30	6	5	5	6	7	3	1	0	0	0	0	0	0	0	0	0	0	0	2	3	3	4	****	****	2.0
MEAN	6.0	6.0	5.4	5.0	4.9	4.9	5.6	5.6	5.3	5.5	6.1	6.6	7.8	5.0	5.3	5.6	4.9	4.7	5.8	5.2	5.8	6.3	7.1	****	5.7

PERCENTAGE OF DATA VALID 76.3

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 3125.00 TOTAL MONTHLY RECORD HOURS = 549.00

TABLE: F-157

OWMC AIR POLLUTION SURVEY

NOX

UNITS PPB

STATION LINCOLN COUNTY

MONTH JUL 1986

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN D
1	7	8	8	5	4	4	****	****	****	7	5	3	0	0	****	1	0	3	10	14	12	10	****	****	5.6
2	7	8	9	8	9	11	8	10	17	22	23	25	21	12	6	5	5	6	7	8	9	6	****	****	11.0
3	7	3	2	2	2	1	3	4	7	8	5	2	0	2	3	2	0	0	0	5	6	6	****	****	3.2
4	11	10	17	13	10	10	12	9	7	5	9	7	5	5	3	14	5	5	4	4	6	5	****	****	8.0
5	6	6	7	8	9	8	9	9	10	11	11	12	13	13	17	15	18	13	12	12	13	13	****	****	11.1
6	11	10	8	7	8	8	8	10	13	16	15	19	20	13	22	12	8	8	15	12	10	11	****	****	12.0
7	10	9	10	12	12	13	14	12	12	13	13	12	15	12	12	11	15	17	17	12	11	13	****	****	12.6
8	10	13	14	12	12	10	12	11	9	11	11	9	8	6	6	10	20	17	40	9	9	11	****	****	12.3
9	7	7	8	7	10	13	12	11	11	11	14	27	22	6	5	3	2	3	4	2	2	6	****	****	8.8
10	6	3	5	4	4	5	6	13	8	4	6	1	0	0	0	1	1	0	0	1	2	8	****	****	3.5
11	9	10	11	15	20	20	****	****	15	20	17	10	10	7	12	8	6	4	3	4	7	12	****	****	11.0
12	17	15	15	11	9	8	10	8	8	8	10	8	5	6	4	4	5	6	6	7	8	8	****	****	8.5
13	11	8	7	6	6	5	6	6	6	6	6	4	6	7	8	8	5	3	3	7	7	7	****	****	6.3
14	2	4	4	2	1	1	1	0	0	0	0	0	0	1	1	1	1	3	2	1	3	3	****	****	1.4
15	5	4	5	5	5	5	5	5	6	7	3	1	0	0	0	6	10	18	4	1	3	5	****	****	4.7
16	6	6	6	7	8	9	8	7	6	9	11	10	7	7	7	6	4	10	26	22	8	7	****	****	9.0
17	6	5	6	7	7	7	8	7	9	9	14	9	14	7	4	4	5	8	10	10	23	13	****	****	8.7
18	9	5	1	1	5	5	4	5	5	4	4	4	5	6	3	2	2	7	4	7	4	5	****	****	4.4
19	5	5	6	4	3	3	3	3	2	3	3	2	3	4	4	1	1	2	2	4	3	3	****	****	3.1
20	3	3	2	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	****	****	0.5
21	3	4	4	4	2	2	0	0	0	0	0	1	0	0	0	4	4	4	3	2	6	8	****	****	2.3
22	5	5	6	5	5	5	8	10	15	7	6	5	2	2	2	2	2	1	2	3	3	6	****	****	4.9
23	3	2	2	2	2	2	1	3	3	8	11	8	3	2	2	1	0	0	0	1	1	2	****	****	2.7
24	13	16	10	12	12	12	10	8	8	4	5	2	3	4	4	3	0	0	0	1	3	2	****	****	6.0
25	3	2	2	5	4	2	3	2	2	2	3	2	0	0	0	0	31	15	4	0	0	0	****	****	3.7
26	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	****	****	0.2
27	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	****	****	0.4
28	6	13	9	6	7	8	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	****	****	2.5
29	0	0	0	0	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	****	****	0.2
30	0	0	0	0	0	0	0	0	2	7	11	9	5	1	6	1	0	1	2	2	1	4	****	****	2.4
31	2	1	2	3	3	2	2	8	1	0	2	0	0	8	****	0	0	1	0	0	0	3	****	****	1.8
MEAN	6.2	6.0	6.0	5.6	5.8	5.8	5.5	5.6	6.1	6.5	7.1	6.2	5.4	4.2	4.5	4.1	4.9	5.0	5.8	4.9	5.2	6.0	****	****	5.6

PERCENTAGE OF DATA VALID 90.7

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 3753.00 TOTAL MONTHLY RECORD HOURS = 675.00

TABLE: F-156

OWMC AIR POLLUTION SURVEY

NOX

UNITS PPB

STATION LINCOLN COUNTY

MONTH AUG 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	0	0	0	0	0	0	0	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
2											DATA MISSING														
3											DATA MISSING														
4											DATA MISSING														
5											DATA MISSING														
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	4	****	****	0.6
7	7	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0	10	10	10	10	10	10	****	****	3.5
8	0	0	0	****	****	40	20	0	0	0	20	0	0	7	0	3	0	5	0	0	0	0	****	****	4.8
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	4	5	4	****	****	0.8
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
13	2	2	0	2	2	1	2	7	4	4	0	8	5	3	2	0	0	0	1	0	0	2	****	****	2.1
14	0	0	0	0	0	0	0	0	0	0	0	1	1	2	2	1	1	1	1	2	2	2	****	****	0.7
15	1	0	1	1	6	7	3	5	6	5	8	8	7	6	4	0	0	35	34	0	1	3	****	****	6.4
16	2	0	0	0	0	0	0	1	4	2	0	0	0	1	4	6	5	6	1	2	1	0	****	****	1.6
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	8	2	****	****	0.8
18	5	1	0	0	0	0	0	1	3	6	0	0	0	0	0	0	0	0	0	0	****	****	****	****	0.8
19	6	2	3	3	0	0	0	****	****	****	****	****	****	****	****	****	****	****	7	10	7	13	****	****	****
20	15	15	15	15	15	10	10	10	10	10	10	10	5	5	5	5	5	5	0	0	10	10	****	****	8.9
21	0	0	0	0	0	0	0	0	0	0	0	0	0	20	20	15	5	0	5	10	5	10	****	****	4.1
22	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	10	****	****	1.1
23	20	20	15	15	10	10	5	5	10	5	5	5	0	0	0	0	0	0	0	0	0	0	****	****	5.7
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	****	****	0.5
25	0	0	0	0	0	0	5	10	10	5	0	0	0	0	0	0	0	0	0	0	0	0	****	****	1.4
26	9	9	8	5	3	2	4	8	9	9	8	6	6	7	6	0	5	5	5	0	0	0	****	****	5.2
27	4	3	4	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.7
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
29	3	4	4	2	0	0	1	3	3	3	2	0	0	0	0	1	2	0	1	1	3	3	****	****	1.6
30	6	5	14	17	14	16	11	10	12	14	11	11	14	10	5	4	4	2	2	5	5	8	****	****	9.1
31	19	13	13	12	12	11	11	14	12	11	8	6	4	2	1	0	1	6	6	6	9	13	****	****	8.6
MEAN	4.0	2.9	3.0	2.9	2.5	3.6	2.7	2.8	3.2	2.8	2.9	2.2	1.7	2.5	2.0	1.4	1.5	3.0	2.9	2.4	3.2	4.0	****	****	2.7

PERCENTAGE OF DATA VALID 77.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 1556.00 TOTAL MONTHLY RECORD HOURS = 573.00

TABLE: F-159

OWMC AIR POLLUTION SURVEY

NOX

UNITS PPB

STATION LINCOLN COUNTY

MONTH SEP 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	9	11	14	10	10	12	10	10	8	8	7	5	2	1	0	0	0	0	0	1	8	15	****	****	6.4
2	26	11	11	7	7	5	6	7	26	19	14	9	5	3	3	2	5	7	8	9	12	11	****	****	9.7
3	15	16	14	13	10	10	15	22	28	18	10	7	4	2	5	8	7	8	8	4	3	1	****	****	10.4
4	3	2	2	2	3	4	2	2	3	3	5	5	5	4	3	4	3	6	6	5	4	4	****	****	3.6
5	4	3	1	1	1	2	2	3	2	0	0	0	0	0	0	0	5	5	3	3	2	3	****	****	1.8
6	3	8	7	1	2	7	6	6	5	8	6	0	0	0	0	0	1	0	1	2	5	7	****	****	3.4
7	2	2	3	2	2	3	3	4	7	0	0	0	0	0	0	0	0	0	0	2	3	2	****	****	1.6
8	4	4	5	5	5	4	6	7	8	7	4	3	3	5	4	2	1	2	3	3	2	4	****	****	4.1
9	4	3	3	3	3	3	3	4	8	7	10	3	6	7	3	2	3	2	1	4	6	12	****	****	4.5
10	14	9	10	8	6	6	8	7	5	9	12	9	10	20	26	22	24	12	9	12	7	1	****	****	11.2
11	1	1	0	0	1	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	****	****	0.3
12	5	5	15	5	3	5	10	10	5	5	5	3	3	3	0	0	0	3	5	3	5	5	****	****	4.7
13	0	0	0	0	0	0	0	0	1	1	0	3	0	1	1	0	0	0	0	0	1	1	****	****	0.4
14	2	4	4	4	4	2	2	4	9	7	3	0	0	0	1	0	1	0	0	0	1	1	****	****	2.2
15	18	10	8	3	2	3	2	3	5	5	6	5	7	11	47	37	20	16	17	11	21	12	****	****	12.2
16	10	10	18	15	8	10	20	30	13	11	18	24	17	13	9	9	8	7	9	11	12	12	****	****	13.4
17	10	13	15	13	10	10	10	10	23	10	5	5	3	3	10	13	8	10	10	10	13	****	****	****	10.2
18	28	23	13	8	8	10	15	18	15	18	30	18	18	18	15	15	13	13	17	17	16	15	****	****	16.4
19	25	20	25	33	40	55	45	25	20	15	10	15	30	10	5	3	3	5	10	15	20	26	****	****	20.7
20	15	8	3	5	23	15	0	0	0	5	5	3	3	0	0	0	0	3	3	3	3	5	****	****	4.6
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	5	3	****	****	0.5
22	13	13	10	8	5	8	5	8	10	10	8	3	5	****	****	****	10	5	5	5	8	33	****	****	9.1
23	3	3	3	5	3	3	0	0	0	3	0	0	0	0	****	****	****	10	8	8	8	8	****	****	3.4
24	5	8	5	5	3	3	3	8	10	10	5	3	0	0	3	5	3	5	3	3	3	5	****	****	4.5
25	5	10	13	10	10	13	20	30	25	18	18	10	10	33	25	25	18	23	20	18	20	23	****	****	18.0
26	38	38	33	33	23	20	13	13	8	13	15	13	13	13	8	8	8	8	8	8	5	15	****	****	16.1
27	10	8	5	3	5	3	0	0	0	3	5	5	8	8	8	10	10	10	12	18	23	15	****	****	7.7
28	10	5	5	3	3	3	3	0	3	3	3	5	5	5	5	5	10	10	10	10	10	8	****	****	5.6
29	5	5	5	5	8	8	8	3	3	3	3	0	0	****	****	****	****	0	0	0	1	0	****	****	3.2
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
MEAN	9.6	8.4	8.3	7.0	6.9	7.6	7.2	7.8	8.3	7.3	6.9	5.2	5.2	5.7	6.7	6.3	5.8	5.7	5.9	6.3	7.6	8.5	****	****	7.0

PERCENTAGE OF DATA VALID 90.1

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 4558.00 TOTAL MONTHLY RECORD HOURS = 649.00

TABLE: F-160

OWMC AIR POLLUTION SURVEY

NOX

UNITS PPB

STATION LINCOLN COUNTY

MONTH OCT 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1											DATA MISSING														
2											DATA MISSING														
3											DATA MISSING														
4											DATA MISSING														
5											DATA MISSING														
6											DATA MISSING														
7	2	1	1	1	0	1	0	1	4	5	6	19	14	5	3	6	2	3	4	3	****	****	****	****	4.1
8	7	6	6	18	11	10	10	12	13	13	16	21	25	25	23	18	21	24	19	14	11	11	****	****	15.2
9	11	15	9	6	6	3	3	6	8	5	1	1	9	1	2	****	****	****	****	****	****	****	****	****	5.7
10	7	8	3	1	1	2	2	3	8	7	3	1	4	3	3	3	6	7	10	12	15	16	****	****	5.7
11	27	21	19	19	18	17	14	13	14	20	24	15	14	13	13	13	8	8	10	13	18	17	****	****	15.8
12	7	5	6	5	5	6	7	33	8	8	12	10	7	8	10	7	6	6	9	9	8	12	****	****	8.8
13	6	4	5	8	7	8	7	7	9	9	9	7	7	4	3	3	5	6	9	7	7	7	****	****	6.5
14	13	21	17	13	14	14	14	11	16	15	11	10	10	10	11	20	13	5	5	6	7	5	****	****	11.9
15	6	6	3	2	1	1	1	1	2	5	2	2	2	2	5	6	6	5	5	5	6	7	****	****	3.7
16	10	7	5	4	4	4	5	6	10	9	10	7	3	1	2	3	3	4	6	7	6	6	****	****	5.5
17	21	27	22	18	17	28	44	27	19	17	20	10	7	5	3	4	4	4	5	4	4	3	****	****	14.2
18	3	1	1	20	24	38	39	40	36	32	22	9	11	12	11	9	7	7	8	5	11	12	****	****	16.3
19	30	15	13	12	16	16	15	12	14	22	18	12	12	11	10	10	14	12	11	11	12	10	****	****	14.0
20	9	8	8	7	8	9	9	11	20	19	24	19	16	10	13	9	6	5	8	8	4	6	****	****	10.7
21	8	4	1	4	8	18	16	11	10	11	12	8	8	12	9	7	7	12	15	12	8	12	****	****	9.7
22	4	5	6	13	14	13	12	12	11	8	7	11	11	14	11	13	21	26	21	15	15	8	****	****	12.3
23	10	9	7	7	7	7	8	9	10	10	10	9	8	6	6	16	12	14	18	22	21	24	****	****	11.4
24	18	17	21	15	10	9	10	11	12	10	4	5	3	1	1	1	2	4	8	10	15	31	****	****	9.9
25	19	17	15	13	12	11	11	15	15	25	26	29	34	34	39	42	43	22	15	20	39	42	****	****	24.5
26	23	20	16	11	9	8	7	8	17	23	22	17	17	18	17	14	16	18	19	25	26	24	****	****	17.0
27	23	20	28	25	21	19	17	16	16	16	14	16	13	7	7	8	6	9	6	7	8	7	****	****	14.0
28	2	1	1	1	1	1	1	2	5	6	5	4	4	14	12	14	7	7	5	4	7	10	****	****	5.2
29	11	10	10	10	9	9	9	10	10	11	11	12	13	13	13	10	12	13	13	5	5	5	****	****	10.2
30	5	5	2	0	0	1	1	2	2	2	10	18	9	11	11	10	11	16	18	19	36	24	****	****	9.7
31	43	40	44	44	41	30	20	21	18	14	6	5	5	4	7	5	7	17	17	8	9	8	****	****	18.8
MEAN	13.0	11.7	10.8	11.1	10.6	11.3	11.3	12.0	12.3	12.9	12.2	11.1	10.6	9.8	9.8	10.5	10.2	10.6	11.0	10.5	13.0	13.3	****	****	11.3

PERCENTAGE OF DATA VALID 72.7

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 6129.00 TOTAL MONTHLY RECORD HOURS = 541.00

TABLE: F-161

OWMC AIR POLLUTION SURVEY

NOX

UNITS PPB

STATION LINCOLN COUNTY

MONTH NOV 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	13	12	11	11	11	13	14	17	19	23	21	19	17	16	15	15	18	17	18	11	8	5	****	****	14.7
2	6	5	2	2	2	2	3	3	3	2	2	1	2	1	1	1	2	3	6	10	14	16	****	****	4.0
3	20	20	16	16	19	13	14	15	18	14	14	13	11	8	7	9	13	5	7	16	11	6	****	****	13.0
4	14	14	15	16	14	5	5	10	9	9	9	12	9	10	9	11	13	14	17	19	22	22	****	****	12.6
5	24	24	18	22	13	14	12	16	27	30	31	****	****	****	****	****	****	****	****	****	****	****	****	****	****
6											DATA MISSING														
7	****	****	****	****	****	****	****	****	****	****	****	****	66	69	57	66	56	51	57	65	65	59	****	****	****
8	40	34	32	34	36	30	34	21	20	21	26	25	26	23	16	13	10	10	12	10	10	7	****	****	22.3
9	6	5	5	4	3	2	2	4	6	6	2	3	7	3	3	2	1	1	0	0	0	0	****	****	3.0
10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	7	9	11	12	17	****	****	2.7
11	30	18	13	8	4	4	4	5	6	9	16	14	12	4	7	10	7	9	7	6	4	2	****	****	9.0
12	5	5	3	3	2	3	4	5	7	37	28	15	33	19	10	****	****	9	9	8	9	9	****	****	11.1
13	2	1	0	0	0	0	0	0	2	6	2	4	1	0	0	0	0	0	0	0	0	1	****	****	0.9
14	1	0	0	0	0	0	0	1	1	3	6	16	6	9	9	9	7	6	7	8	9	10	****	****	4.9
15	23	22	20	10	6	6	5	6	11	32	15	19	44	21	18	16	16	17	14	12	11	12	****	****	16.2
16	13	17	23	23	19	15	11	10	10	11	13	13	13	12	13	11	12	14	19	14	12	10	****	****	14.0
17	10	8	8	7	6	8	10	11	22	11	15	17	20	21	16	19	15	18	20	17	14	13	****	****	13.9
18	17	17	17	15	15	21	15	15	14	15	8	6	5	6	7	5	3	5	2	1	0	2	****	****	9.6
19	9	3	0	0	0	0	0	3	3	5	1	0	0	0	****	****	9	12	15	14	21	20	****	****	5.8
20	22	18	20	16	11	13	15	15	14	17	14	18	36	19	17	18	****	****	53	57	41	27	****	****	23.0
21	50	31	21	15	11	8	9	10	12	13	11	12	14	8	9	10	9	10	6	15	14	15	****	****	14.2
22	16	15	14	16	14	13	14	14	16	19	16	17	14	14	10	8	12	14	17	20	20	20	****	****	15.1
23	17	21	23	41	47	16	13	11	13	16	17	16	17	16	15	16	22	21	16	12	13	13	****	****	18.7
24	13	13	14	9	3	4	5	5	5	4	4	4	4	4	5	5	8	****	****	****	17	17	****	****	7.5
25	10	10	11	11	13	12	12	12	14	16	14	15	13	21	21	19	22	14	26	28	31	33	****	****	17.2
26	37	85	133	126	113	96	68	67	89	102	76	33	21	20	18	28	24	36	65	42	35	23	****	****	60.8
27	23	21	18	15	13	11	12	10	11	12	12	9	****	****	14	22	14	7	8	10	14	12	****	****	13.4
28	9	15	5	6	7	8	11	19	27	46	10	****	****	****	****	****	24	25	19	20	21	21	****	****	17.2
29	26	14	11	11	15	19	19	19	21	21	21	15	12	14	11	15	15	16	11	8	16	29	****	****	16.3
30	16	12	15	9	9	9	8	5	3	3	3	3	3	3	3	3	3	3	5	6	6	6	****	****	6.2
MEAN	16.9	16.4	16.7	15.9	14.5	12.3	11.4	11.8	14.4	18.0	14.5	12.3	15.6	13.1	12.0	13.3	13.0	13.2	16.5	16.3	16.1	15.3	****	****	14.5

PERCENTAGE OF DATA VALID 83.2

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 8711.00 TOTAL MONTHLY RECORD HOURS = 599.00

TABLE: F-162

OWMC AIR POLLUTION SURVEY

NOX

UNITS PPB

STATION LINCOLN COUNTY

MONTH DEC 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	13	9	7	7	6	6	7	9	9	10	10	11	****	****	15	17	18	19	20	19	21	21	****	****	12.7
2	18	16	19	16	14	16	20	18	20	25	28	55	58	47	52	60	48	35	24	23	22	23	****	****	29.9
3	21	20	22	21	22	23	21	23	26	36	44	50	57	40	18	15	****	****	****	10	14	7	****	****	25.8
4	8	6	6	5	5	4	6	5	4	6	6	6	6	5	7	8	5	5	8	9	9	10	****	****	6.3
5	5	4	4	4	5	4	5	6	7	6	6	7	8	0	10	10	10	9	5	9	8	7	****	****	6.3
6	11	10	10	8	10	11	12	16	16	16	21	24	19	22	23	25	24	24	24	26	26	28	****	****	18.5
7	28	27	29	30	27	29	31	22	20	24	25	21	27	22	22	29	19	21	22	25	27	26	****	****	25.1
8	24	21	15	12	7	4	4	4	10	6	5	8	8	8	10	10	11	****	10	11	14	****	****	19	10.5
9	16	17	18	19	20	19	20	22	30	38	51	58	54	71	75	66	66	135	160	109	58	****	****	****	53.4
10	13	13	18	17	14	14	11	8	7	6	7	7	8	10	11	****	10	9	9	11	13	****	****	****	10.8
11	17	15	15	16	17	17	17	17	23	18	11	12	11	12	11	15	27	30	25	27	29	****	****	31	18.8
12	40	22	11	11	9	9	11	10	8	9	7	5	5	5	4	4	7	4	5	5	4	****	****	7	9.2
13	7	5	4	5	5	12	9	8	7	6	14	8	6	7	4	3	3	3	5	6	7	****	****	9	6.5
14	11	6	7	7	8	8	12	18	18	23	32	24	17	14	14	27	13	16	15	14	13	****	****	18	15.2
15	16	16	15	14	14	14	14	15	14	13	13	14	39	13	****	****	****	****	17	16	14	****	****	20	16.2
16	18	16	21	25	25	25	25	28	29	32	31	29	27	30	35	33	39	41	48	49	46	****	****	60	32.4
17	56	55	60	50	51	63	75	80	78	79	49	39	49	60	47	31	****	****	****	****	****	****	****	****	57.6
18											DATA MISSING														
19											DATA MISSING														
20											DATA MISSING														
21											DATA MISSING														
22	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	16	****
23	11	10	11	20	14	13	14	18	19	19	18	19	20	25	30	30	29	24	23	21	20	****	****	24	19.6
24	23	20	19	15	20	25	25	15	16	17	20	21	26	20	19	20	19	20	22	22	21	****	****	20	20.2
25	****	****	****	17	18	17	16	15	17	16	14	12	10	9	7	7	7	7	7	7	7	****	****	10	11.6
26	8	7	7	6	6	6	5	5	5	6	6	6	7	7	9	10	10	11	11	12	13	****	****	17	8.2
27	15	14	13	12	11	11	12	11	11	14	14	15	19	18	16	14	12	15	16	20	16	****	****	18	14.4
28	18	14	13	12	11	11	9	9	9	11	16	15	14	12	14	29	34	21	18	24	27	****	****	18	16.3
29	16	16	15	16	17	18	20	21	19	19	22	21	21	20	20	20	23	21	44	37	31	****	****	53	23.2
30	44	46	47	48	70	61	57	55	51	44	26	19	21	52	61	25	18	17	18	46	41	****	****	19	40.3
31	16	13	10	9	9	9	9	10	11	12	13	11	14	12	11	16	17	17	18	17	16	****	****	16	13.0
MEAN	18.9	16.7	16.6	16.2	16.7	17.3	18.0	18.0	18.6	19.7	19.6	19.9	22.0	21.6	21.8	21.8	20.4	22.9	23.9	23.0	20.7	****	****	22.1	19.7

PERCENTAGE OF DATA VALID 74.1

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 10866.00 TOTAL MONTHLY RECORD HOURS = 551.00

TABLE: F-163

OWMC AIR POLLUTION SURVEY

NOX

UNITS PPB

STATION LINCOLN COUNTY

MONTH JAN 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	11	11	11	11	11	14	23	13	11	12	17	15	12	10	11	20	26	21	18	20	22	****	****	21	15.5
2	23	26	20	12	12	11	10	9	9	8	6	6	6	7	10	12	18	18	18	16	14	****	****	17	13.1
3	26	16	12	10	7	6	8	7	5	5	8	9	7	7	8	9	9	11	41	47	43	****	****	46	15.8
4	10	31	33	39	42	44	44	48	54	55	50	47	32	24	22	20	19	20	27	30	33	****	****	34	34.5
5	36	44	43	37	31	28	24	24	28	37	39	32	36	37	46	52	44	50	45	40	45	****	****	42	38.2
6	45	43	42	36	30	27	23	23	28	36	38	31	35	36	45	50	43	49	45	39	45	****	****	41	37.7
7	40	38	31	23	22	20	18	20	22	26	24	22	21	17	15	18	14	15	12	10	9	****	****	12	20.4
8	9	8	8	7	9	10	9	6	5	6	5	4	5	8	9	10	11	13	12	10	12	****	****	11	8.5
9	10	11	11	11	11	9	9	10	12	11	11	11	12	15	14	18	15	13	13	15	25	****	****	54	14.6
10	36	23	19	22	24	24	26	27	29	37	40	38	35	33	25	23	24	24	22	23	25	****	****	26	27.5
11	24	35	36	36	35	27	20	14	10	10	8	8	7	6	5	5	5	6	7	9	9	****	****	16	15.4
12	13	12	12	12	12	12	12	12	12	12	12	12	13	13	13	13	9	13	12	13	9	****	****	10	12.0
13	8	7	7	6	6	5	6	7	7	8	6	5	6	7	7	8	12	15	14	15	16	****	****	42	10.0
14	25	20	21	25	35	33	31	40	33	35	39	28	28	33	42	27	27	29	28	68	52	****	****	35	33.4
15	35	30	29	27	32	28	28	26	26	25	25	25	19	19	12	10	10	11	10	11	13	****	****	10	21.0
16	11	9	10	9	7	7	8	9	8	9	9	8	8	9	10	12	15	16	13	14	18	****	****	18	10.8
17	21	18	13	12	15	13	13	12	7	9	33	16	24	20	14	12	13	14	12	13	20	****	****	31	16.1
18	29	27	25	24	19	19	19	19	21	24	27	31	38	29	25	21	16	15	16	17	15	****	****	19	22.5
19	17	15	15	13	13	14	17	21	24	18	11	8	9	9	11	9	10	12	8	6	6	****	****	8	12.5
20	12	20	18	8	9	12	11	10	12	12	11	13	11	9	23	13	8	8	9	9	12	****	****	16	12.1
21	15	15	11	10	10	10	7	12	17	18	15	13	10	13	24	14	18	21	10	12	9	****	****	10	13.4
22	9	8	7	12	12	8	8	9	13	14	14	16	16	16	17	19	23	21	22	27	33	****	****	30	16.1
23	22	28	31	35	25	4	4	3	3	4	3	3	3	2	3	3	3	4	5	4	4	****	****	7	9.2
24	6	4	5	7	3	7	7	9	7	7	5	5	5	4	3	4	6	10	9	5	7	****	****	16	6.4
25	16	11	10	9	9	9	9	8	7	9	10	7	7	7	7	9	13	10	12	18	22	****	****	****	10.4
26	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	19	22	19	****	****	****	****	52	****
27	****	****	****	****	****	****	****	****	****	****	****	44	40	38	39	26	22	25	20	19	19	****	****	20	****
28	19	22	31	35	36	35	30	37	35	34	34	29	27	32	31	****	****	76	59	60	60	****	****	31	37.7
29	26	20	17	18	19	19	20	22	25	30	29	27	25	23	33	36	****	****	60	48	37	****	****	38	28.6
30	36	31	38	21	16	16	15	17	20	24	23	22	24	25	29	31	34	45	28	24	21	****	****	14	25.2
31	13	14	13	13	11	11	10	10	9	8	8	8	8	8	12	13	11	9	10	11	9	****	****	12	10.5
MEAN	20.8	20.6	20.0	18.6	18.0	16.6	16.2	16.7	17.2	18.7	19.3	18.1	17.6	17.2	18.8	17.8	17.1	20.5	20.5	21.8	22.1	****	****	24.6	19.1

PERCENTAGE OF DATA VALID 87.1

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 12354.00 TOTAL MONTHLY RECORD HOURS = 648.00

TABLE: F-164

OWMC AIR POLLUTION SURVEY

NOX

UNITS PPB

STATION LINCOLN COUNTY

MONTH FEB 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	14	11	13	14	15	13	11	10	10	10	13	13	13	20	21	19	21	23	22	20	20	****	****	25	16.0
2	21	19	19	21	24	31	21	21	22	21	21	21	19	23	23	27	26	24	23	25	19	****	****	17	22.2
3	16	34	38	27	25	20	20	22	25	20	19	23	28	23	15	10	9	8	8	7	6	****	****	6	18.6
4	5	5	5	5	5	5	5	5	5	5	6	10	10	6	5	5	11	13	11	10	11	****	****	10	7.2
5	8	11	12	12	11	10	9	11	10	8	6	5	32	17	17	32	6	7	15	24	30	****	****	21	14.3
6	21	22	21	21	22	26	28	31	30	30	29	32	39	37	32	26	25	53	44	42	39	****	****	28	30.8
7	26	21	20	20	19	19	15	15	13	14	14	13	12	11	11	13	16	17	18	17	17	****	****	19	16.4
8	19	18	18	16	17	18	22	22	21	19	19	18	11	10	11	10	13	13	12	10	12	****	****	14	15.6
9	11	7	7	6	5	7	9	11	17	40	46	29	14	19	10	7	8	9	10	12	16	****	****	45	15.7
10	44	42	27	15	16	14	13	15	16	15	****	****	****	****	****	****	****	14	15	20	18	****	****	20	20.3
11	17	18	16	14	12	12	12	15	24	23	26	33	22	23	25	24	20	16	17	18	23	****	****	20	19.5
12	28	41	90	72	61	52	34	29	30	28	21	22	13	11	11	11	29	34	27	18	23	****	****	7	31.5
13	5	5	4	3	2	2	2	4	7	9	13	15	12	11	12	12	9	15	18	26	24	****	****	33	11.0
14	32	29	15	6	4	4	9	9	7	7	10	8	10	6	5	5	6	7	11	22	16	****	****	8	10.7
15	5	3	3	2	1	2	3	3	4	5	5	5	11	9	6	4	8	6	8	8	13	****	****	4	5.4
16	3	3	2	4	3	5	5	9	13	15	8	6	5	5	6	9	14	14	17	15	10	****	****	14	8.4
17	11	13	12	25	21	23	16	15	17	13	9	8	7	7	8	8	7	8	9	14	17	****	****	26	13.4
18	28	23	23	24	15	12	8	12	15	14	5	5	7	9	7	12	27	47	47	40	31	****	****	32	20.1
19	23	18	13	13	13	11	13	16	20	25	15	8	13	20	28	22	14	10	13	14	12	****	****	21	16.1
20	21	22	36	40	33	31	35	36	35	33	24	14	14	17	19	18	16	14	16	17	17	****	****	24	24.2
21	23	25	21	22	19	18	18	17	31	22	19	15	13	11	9	7	6	27	33	30	31	****	****	33	20.5
22	35	40	48	54	51	50	38	52	47	35	30	24	28	23	14	22	28	30	17	19	20	****	****	16	32.8
23	14	11	11	12	11	11	22	22	29	47	46	60	43	27	13	****	****	****	10	10	11	****	****	12	22.2
24	13	8	8	8	8	8	9	14	21	15	12	12	16	12	17	15	11	11	11	13	17	****	****	19	12.6
25	15	16	14	13	13	15	20	21	32	29	29	30	20	21	22	22	20	20	23	22	34	****	****	36	22.1
26	46	38	39	48	41	44	38	34	26	27	24	12	9	10	12	24	21	24	23	24	24	****	****	25	27.9
27	23	23	20	21	21	35	47	43	37	19	21	27	24	18	15	15	17	19	23	23	26	****	****	37	25.2
28	37	32	31	36	38	16	13	14	14	27	51	33	20	26	42	41	32	33	37	39	33	****	****	****	30.7
MEAN	20.1	19.9	20.9	20.5	18.8	18.4	17.7	18.9	20.6	20.5	20.0	18.6	17.2	16.0	15.4	16.2	16.2	19.1	19.2	20.0	20.4	****	****	21.2	18.9

PERCENTAGE OF DATA VALID 90.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 11448.00 TOTAL MONTHLY RECORD HOURS = 605.00

TABLE: F-165

DWMC AIR POLLUTION SURVEY

NOX

UNITS PPB

STATION LINCOLN COUNTY

MONTH MAR 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	23	22	22	20	20	22	22	21	22	25	25	25	25	29	33	28	24	26	27	38	30	****	****	23	25.1
2	20	25	20	16	14	14	12	9	8	8	8	8	8	7	6	6	5	5	6	6	7	****	****	8	10.3
3	7	7	6	7	6	6	7	6	6	7	****	****	****	****	****	****	****	****	****	13	****	****	****	8	7.2
4	6	5	8	9	8	12	13	13	11	14	9	7	****	****	14	10	7	8	7	7	7	****	****	7	9.1
5	6	5	5	6	6	7	7	8	9	9	7	7	7	****	****	12	16	15	19	15	19	****	****	26	10.6
6	22	25	24	25	24	22	22	24	25	29	32	36	36	40	40	60	58	48	46	40	34	****	****	26	33.5
7	26	24	19	23	23	30	29	28	33	32	26	23	25	29	30	25	25	35	20	33	20	****	****	17	26.1
8	16	14	13	12	12	12	12	11	12	15	23	28	21	20	24	29	22	21	24	23	21	****	****	29	18.8
9	27	20	13	9	8	7	7	7	7	6	6	4	4	4	3	3	2	2	3	3	2	****	****	3	6.8
10	2	2	2	2	2	2	2	3	3	4	3	3	3	4	3	4	6	7	7	11	11	****	****	6	4.2
11	12	18	19	28	35	38	28	22	27	15	13	12	11	12	12	12	15	19	22	14	13	****	****	14	18.7
12	13	15	14	17	19	22	33	47	51	38	28	23	30	22	13	11	13	13	11	11	9	****	****	17	21.4
13	19	22	22	18	17	17	20	18	13	13	13	13	13	7	7	7	7	8	8	8	8	****	****	14	13.3
14	12	12	19	13	14	15	19	22	15	12	12	9	8	9	8	9	12	12	11	11	11	****	****	9	12.5
15	9	11	9	8	7	8	8	11	8	7	6	6	6	6	4	6	4	6	7	12	20	****	****	29	9.0
16	23	17	17	15	14	13	14	19	13	13	6	6	4	4	6	7	9	20	23	20	14	****	****	17	13.4
17	20	24	20	19	17	20	15	20	22	28	25	24	18	13	9	8	15	24	18	24	17	****	****	17	19.0
18	19	25	29	24	23	20	23	24	24	12	11	9	9	8	4	4	4	6	8	12	14	****	****	29	15.5
19	57	35	38	57	67	60	51	29	31	38	27	13	17	20	15	13	8	13	18	27	31	****	****	33	31.7
20	24	24	25	18	16	12	12	13	18	30	25	19	17	14	13	18	11	12	14	15	13	****	****	14	17.1
21	14	12	10	15	28	37	31	28	28	29	21	17	13	15	14	17	18	18	19	19	17	****	****	20	20.0
22	19	21	21	19	17	15	17	25	24	20	16	15	13	11	11	11	12	13	16	22	21	****	****	29	17.6
23	28	21	17	17	16	17	23	33	28	28	19	13	33	28	24	13	10	12	13	15	17	****	****	23	20.4
24	30	27	26	25	30	35	32	29	27	20	12	10	10	18	16	18	22	22	17	17	18	****	****	30	22.3
25	12	12	11	10	10	12	12	13	19	17	17	17	18	20	17	18	17	17	17	15	11	****	****	10	14.6
26	10	9	8	8	10	10	9	9	10	9	20	22	25	11	12	13	15	13	13	13	13	****	****	13	12.5
27	13	13	13	13	13	13	13	14	15	12	14	16	12	13	12	9	8	10	25	35	42	****	****	42	16.8
28	42	40	30	29	23	17	20	22	24	20	18	12	13	11	12	15	10	8	10	10	10	****	****	15	18.7
29	18	17	18	18	17	28	25	25	19	13	18	13	20	17	18	17	16	17	20	21	58	****	****	10	20.1
30	11	13	13	14	14	13	12	12	14	14	15	15	25	30	27	12	13	19	33	29	22	****	****	7	17.1
31	6	6	6	5	5	5	5	6	7	7	9	12	9	7	5	5	6	5	5	4	5	****	****	7	6.2
MEAN	18.3	17.5	16.7	16.7	17.3	18.1	17.9	18.4	18.5	17.5	16.1	14.6	15.6	15.3	14.2	14.0	13.7	15.1	16.2	17.5	17.8	****	****	17.8	16.6

PERCENTAGE OF DATA VALID 89.8

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 11100.00 TOTAL MONTHLY RECORD HOURS = 668.00

TABLE: F-166

OWMC AIR POLLUTION SURVEY

NOX

UNITS PPB

STATION LINCOLN COUNTY

MONTH APR 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	6	5	5	5	4	4	5	12	19	12	11	10	7	7	9	9	9	11	13	15	16	****	****	16	9.5
2	15	14	14	14	13	10	12	10	11	10	9	8	8	8	9	****	****	10	9	9	8	****	****	9	10.5
3	8	8	7	6	7	6	7	7	6	6	5	5	5	5	4	5	5	7	11	14	21	****	****	17	7.8
4	15	10	17	14	11	9	8	8	8	10	10	11	11	11	11	11	10	10	9	8	9	****	****	9	10.5
5	9	9	9	9	9	9	9	9	10	9	10	10	10	10	11	12	13	10	12	11	12	12	****	****	10.2
6	9	9	9	9	9	9	9	10	11	12	12	11	11	11	13	15	13	13	14	11	10	10	****	****	10.9
7	40	28	31	26	21	17	16	19	27	38	41	24	25	20	21	16	17	14	19	19	15	11	****	****	23.0
8	14	12	12	11	10	10	11	15	20	29	30	29	27	20	14	10	11	17	17	11	11	****	****	16	16.2
9	12	14	13	17	16	16	15	16	19	19	21	13	11	9	11	10	11	10	9	8	9	****	****	11	13.2
10	10	9	8	8	8	9	9	15	23	25	25	26	31	25	21	17	15	16	16	13	13	****	****	25	16.7
11	25	22	17	23	18	17	16	15	15	15	14	29	36	27	21	17	15	14	12	13	13	****	****	11	18.4
12	11	12	11	12	12	14	13	16	24	41	27	21	24	24	21	16	19	21	22	21	21	****	****	10	18.8
13	10	12	11	20	24	17	19	22	25	19	12	12	11	****	****	****	****	****	****	15	13	****	****	33	17.2
14	32	24	29	27	26	21	22	25	23	18	13	12	23	27	20	20	19	21	23	22	24	****	****	26	22.6
15	25	28	31	27	21	17	18	22	27	19	17	16	17	33	37	18	14	15	16	16	13	****	****	13	20.9
16	12	12	10	9	9	10	12	14	13	13	19	34	23	17	20	19	19	19	18	14	17	****	****	11	15.6
17	10	10	11	13	15	16	20	16	16	14	13	13	13	16	15	15	15	16	15	14	12	****	****	10	14.0
18	11	12	16	17	15	12	11	9	11	17	15	11	11	11	9	9	10	11	12	11	11	****	****	14	12.1
19	10	10	11	10	10	10	11	11	10	12	14	15	19	15	13	11	9	10	10	10	11	****	****	10	11.5
20	9	10	10	8	8	12	13	19	21	22	29	38	32	21	18	17	16	14	13	14	17	****	****	20	17.3
21	24	27	30	34	21	14	13	21	23	****	****	20	23	18	17	19	16	15	16	21	19	****	****	11	20.1
22	9	7	6	6	5	6	8	8	10	10	10	8	9	9	10	10	10	10	11	10	11	****	****	13	8.9
23	15	16	16	14	11	12	12	14	17	18	16	17	29	36	25	21	24	24	22	21	21	****	****	20	19.1
24	17	14	13	14	12	9	8	7	7	7	6	6	6	6	5	6	6	7	7	8	12	****	****	17	9.1
25	16	12	8	9	11	12	11	11	11	9	6	8	9	8	7	7	8	9	11	12	15	****	****	14	10.2
26	9	8	11	14	14	12	13	15	15	14	11	10	13	8	10	8	9	7	7	10	11	****	****	15	11.1
27	18	23	19	18	14	15	21	23	18	14	14	14	14	23	22	19	25	16	19	23	21	****	****	16	18.6
28	15	14	9	8	7	7	9	8	9	9	9	9	9	9	9	10	****	****	8	6	6	****	****	6	8.8
29	5	5	7	6	7	6	12	16	16	14	9	10	15	11	6	4	3	3	****	****	6	****	****	8	8.4
30	7	6	4	4	3	5	5	6	7	9	9	6	7	5	5	****	****	6	7	5	6	****	****	7	5.9
MEAN	14.3	13.4	13.5	13.7	12.4	11.4	12.3	14.0	15.7	16.0	15.1	15.2	16.3	15.5	14.3	13.0	13.1	12.7	13.5	13.3	13.5	****	****	14.4	13.9

PERCENTAGE OF DATA VALID 89.4

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 8966.00 TOTAL MONTHLY RECORD HOURS = 644.00

TABLE: F-167

OWMC AIR POLLUTION SURVEY

NOX

UNITS PPB

STATION LINCOLN COUNTY

MONTH MAY 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	6	6	6	6	9	10	12	13	11	7	6	5	5	6	19	10	8	7	7	7	8	****	****	11	8.4
2	9	7	7	7	7	7	8	11	14	15	37	15	11	11	10	10	10	9	9	9	13	****	****	19	11.6
3	24	18	17	19	17	16	15	11	7	9	9	9	9	8	9	8	5	5	5	6	10	****	****	15	11.4
4	8	6	6	9	16	10	7	7	7	7	8	8	7	6	5	4	4	4	4	5	9	****	****	10	7.1
5	9	9	10	15	29	25	24	23	21	23	16	14	12	9	9	9	10	12	11	9	10	****	****	13	14.6
6	9	9	10	16	21	18	17	17	16	14	11	8	8	11	****	****	25	19	18	15	10	****	****	12	14.2
7	12	10	8	11	11	9	10	12	16	17	17	16	11	8	6	6	7	8	9	6	7	****	****	20	10.8
8	19	17	19	43	35	27	25	27	24	12	7	7	8	7	13	12	12	15	14	6	7	****	****	10	16.6
9	8	7	9	11	9	10	12	14	17	17	35	41	36	30	18	22	35	35	24	20	18	****	****	6	19.7
10	7	7	10	11	12	12	13	11	12	13	11	11	13	13	11	10	8	10	8	8	10	****	****	11	10.5
11	11	11	11	13	11	10	11	11	14	15	14	13	63	50	49	6	5	5	5	6	7	****	****	7	15.8
12	8	10	7	4	6	5	5	****	****	****	****	****	****	****	****	20	13	14	18	16	13	****	****	14	10.9
13	19	26	23	22	21	13	16	19	13	16	18	15	13	11	10	9	10	9	10	11	14	****	****	14	15.1
14	15	12	11	11	10	11	11	13	15	14	15	16	14	13	12	13	13	12	13	14	15	****	****	10	12.9
15	8	9	9	10	8	8	7	9	13	21	25	16	13	****	****	14	13	19	20	26	20	****	****	25	14.6
16	25	23	21	21	21	22	22	20	22	19	18	15	20	18	15	16	11	7	7	9	9	****	****	11	16.9
17	8	9	10	12	14	15	16	20	22	21	19	23	****	****	****	****	****	****	****	****	****	****	****	****	15.8
18	13	10	10	10	9	8	8	9	10	10	11	13	15	13	10	10	13	9	11	11	9	****	****	9	10.5
19	7	9	7	6	7	6	9	9	12	14	13	13	13	13	16	16	15	15	16	16	18	****	****	11	11.9
20	11	11	12	13	11	10	8	7	7	7	7	7	7	7	7	7	7	7	12	11	11	****	****	9	8.9
21	15	10	8	10	10	10	9	11	13	19	25	16	11	9	9	11	10	22	31	32	33	****	****	18	15.5
22	20	13	15	12	12	11	13	14	15	17	14	15	11	16	20	13	17	9	23	12	12	****	****	8	14.2
23	8	8	8	9	8	9	9	8	8	8	8	6	6	6	6	5	5	6	5	6	9	****	****	6	7.1
24	5	7	9	10	8	7	7	6	7	6	5	5	4	4	5	6	5	4	8	12	11	****	****	11	6.9
25	13	12	15	11	10	13	19	14	10	11	9	10	12	11	15	13	8	8	10	11	15	****	****	12	11.9
26	12	10	7	6	5	4	6	11	13	16	25	25	26	24	15	10	19	18	21	20	19	****	****	12	14.7
27	10	9	8	7	7	8	9	9	10	14	12	10	10	8	6	6	5	6	6	6	10	****	****	8	8.4
28	7	7	6	7	7	8	8	10	11	12	11	10	9	9	10	6	7	7	6	5	5	****	****	10	8.1
29	10	10	10	10	8	9	9	11	10	9	6	6	5	5	7	6	5	5	6	6	6	****	****	11	7.7
30	10	10	9	6	6	8	10	12	11	10	10	9	9	10	6	5	5	5	5	7	8	****	****	6	8.0
31	6	7	7	4	5	5	5	5	7	7	7	7	7	7	7	6	5	5	5	5	5	****	****	8	6.0
MEAN	11.4	10.6	10.5	11.7	11.9	11.1	11.6	12.5	12.9	13.3	14.3	12.8	13.4	12.3	12.0	10.0	10.5	10.5	11.6	11.1	11.7	****	****	11.6	11.8

PERCENTAGE OF DATA VALID 88.7

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 7771.00 TOTAL MONTHLY RECORD HOURS = 660.00

TABLE: F-16B

OWMC AIR POLLUTION SURVEY

OZONE

UNITS PPB

STATION LINCOLN COUNTY

MONTH JUN 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1											DATA MISSING														
2	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	14	14	13	10	9	6	6	5	****
3	1	1	0	0	0	0	0	4	6	8	9	10	13	13	13	13	13	13	9	8	6	4	2	1	6.1
4	0	4	4	5	6	5	6	6	8	8	9	13	18	20	20	20	18	16	16	16	16	****	****	12	11.2
5	10	9	9	8	5	5	6	6	6	8	8	9	9	9	9	6	4	4	4	2	2	2	2	****	6.2
6	4	4	5	4	4	4	2	2	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
7	9	14	14	16	16	16	16	17	17	13	12	13	13	16	17	20	27	31	29	33	37	40	****	****	19.8
8	****	28	27	28	28	27	24	22	20	22	24	28	22	24	28	25	27	27	24	22	21	20	16	9	23.6
9	10	12	10	9	10	9	9	10	16	18	20	****	****	****	****	35	****	****	33	31	28	18	14	20	17.3
10	16	10	14	17	16	10	8	10	9	18	22	29	32	36	37	40	44	44	44	44	41	41	39	27	27.0
11	17	28	22	18	18	18	17	18	18	13	17	17	28	37	36	41	37	32	31	28	24	21	18	9	23.5
12	12	17	20	17	16	16	14	13	14	13	12	12	17	24	20	25	28	29	29	35	32	29	20	12	19.8
13	17	14	10	10	13	14	13	13	14	16	17	20	22	22	22	22	22	27	31	33	31	22	21	18	19.3
14	17	9	4	4	9	6	2	2	2	1	4	9	22	27	31	33	33	32	28	27	25	22	14	9	15.5
15	16	14	17	17	16	12	12	17	18	21	22	27	32	32	31	31	25	24	24	22	17	13	25	20	21.0
16	20	33	33	32	29	29	29	27	27	28	31	33	37	41	43	43	****	****	33	21	18	18	****	****	30.3
17	12	10	9	9	9	8	6	6	9	10	12	14	14	16	17	18	18	18	17	17	17	14	12	6	12.4
18	8	9	6	5	4	4	4	5	8	****	13	16	18	21	21	20	24	24	22	21	20	17	17	****	14.0
19	16	17	17	18	17	17	20	18	18	20	17	17	14	****	12	21	22	23	21	18	18	8	4	****	17.0
20	12	11	10	16	21	20	17	19	16	14	28	29	37	41	42	42	39	30	26	26	20	11	8	****	23.3
21											DATA MISSING														
22											DATA MISSING														
23	****	****	****	****	****	****	****	****	****	****	****	****	****	****	47	46	54	55	52	50	51	58	46	****	****
24	46	48	38	42	40	46	38	34	37	44	44	35	26	20	15	20	****	****	****	****	****	****	****	****	35.8
25	****	****	****	****	****	****	****	****	****	****	****	****	36	38	40	42	42	40	42	42	38	33	****	****	****
26	15	14	14	14	13	8	15	15	26	36	45	62	60	67	70	78	88	78	88	85	86	86	****	****	48.3
27	70	68	64	65	65	65	66	72	76	75	50	50	48	64	65	65	51	50	55	55	54	50	****	****	61.0
28	51	46	40	33	25	17	24	20	33	38	43	49	52	55	55	50	51	50	55	55	54	50	****	****	43.0
29	37	39	26	19	17	20	21	25	27	27	31	35	38	42	44	45	47	36	34	32	27	19	****	****	31.3
30	12	15	10	9	8	6	7	11	17	21	24	27	28	32	39	29	****	****	****	****	****	****	****	****	18.4
MEAN	18.6	19.8	17.6	17.3	16.9	15.9	15.7	16.3	19.2	21.5	22.3	25.2	27.7	31.7	32.3	33.2	33.1	31.7	31.7	30.5	28.8	26.2	16.5	****	23.7

PERCENTAGE OF DATA VALID 75.3

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 12838.00 TOTAL MONTHLY RECORD HOURS = 542.00

TABLE: F-169

OWMC AIR POLLUTION SURVEY

OZONE

UNITS PPB

STATION LINCOLN COUNTY

MONTH JUL 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	13	6	3	3	2	2	****	****	****	****	****	****	****	****	52	55	53	52	44	36	36	38	****	****	28.2
2	32	31	37	39	35	31	31	30	24	22	24	42	62	73	78	79	77	63	60	54	43	33	****	****	45.5
3	24	26	25	23	22	19	19	19	18	21	24	26	29	33	36	40	40	40	38	32	23	18	****	****	27.0
4	4	3	2	1	0	3	5	14	24	32	51	58	61	61	63	56	67	72	74	75	75	74	****	****	39.8
5	63	53	51	52	46	51	46	50	50	54	58	64	70	77	82	84	82	77	87	86	80	73	****	****	65.3
6	66	67	66	64	55	54	49	49	55	61	64	77	82	90	87	91	99	95	86	82	80	76	****	****	72.5
7	65	65	58	50	44	35	30	35	34	36	43	56	59	65	54	58	51	50	41	37	31	27	****	****	46.5
8	19	8	9	10	10	18	20	21	28	38	38	39	38	42	41	32	41	26	50	50	41	41	****	****	30.0
9	44	34	31	28	23	20	21	23	27	29	27	21	30	47	56	54	51	48	37	34	30	24	****	****	33.6
10	11	13	12	12	12	9	9	12	19	26	31	34	36	36	47	52	52	48	42	34	27	16	****	****	26.8
11	24	17	13	8	5	****	****	13	18	19	21	29	28	38	31	41	46	45	44	41	36	28	****	****	27.3
12	16	16	15	19	19	19	19	16	16	20	21	29	30	31	35	35	36	37	39	36	29	26	****	****	25.4
13	****	****	****	****	****	****	****	****	****	****	****	****	35	37	41	42	42	44	45	51	51	45	****	****	****
14	31	31	28	27	27	25	24	24	27	33	35	32	35	39	41	39	35	33	31	26	17	20	****	****	30.0
15	11	9	8	7	6	6	6	8	10	15	25	30	31	33	36	36	30	26	27	29	24	20	****	****	19.7
16	16	12	10	5	7	8	11	20	33	36	27	29	36	36	40	44	47	42	31	31	39	37	****	****	27.1
17	24	24	22	22	23	26	12	11	13	20	25	32	23	35	46	51	56	62	66	62	45	53	****	****	34.2
18	58	36	36	34	25	22	19	21	26	32	40	48	55	58	62	66	62	55	56	50	40	37	****	****	42.6
19	29	27	24	32	32	26	27	25	23	23	26	31	29	31	31	34	37	41	48	44	45	45	****	****	32.3
20	46	50	55	50	45	36	26	24	27	28	26	25	32	44	44	40	39	36	31	26	21	18	****	****	35.0
21	11	12	12	11	12	13	16	14	14	15	15	15	19	23	29	42	56	66	66	54	39	36	****	****	26.8
22	27	23	17	14	11	6	5	7	18	30	44	48	55	51	57	55	55	59	61	60	54	40	****	****	36.2
23	30	29	23	21	21	16	18	16	23	25	31	53	66	64	62	61	59	57	51	48	39	38	****	****	38.7
24	9	3	8	6	5	10	12	13	10	34	45	56	58	59	59	59	62	61	52	57	71	58	****	****	36.7
25	45	52	46	31	39	50	50	52	60	66	69	78	82	80	74	88	61	61	64	65	67	60	****	****	60.9
26	56	47	50	43	33	30	26	19	19	24	32	32	29	27	24	31	32	32	35	36	34	31	****	****	32.8
27	20	23	23	15	13	12	11	12	14	15	18	21	26	28	31	34	36	37	39	33	24	18	****	****	22.9
28	10	3	0	0	0	0	1	10	21	33	39	44	45	45	46	47	47	51	50	48	42	51	****	****	28.8
29	46	42	34	33	29	24	16	14	18	23	25	28	27	28	27	31	32	30	30	25	24	23	****	****	27.7
30	19	18	19	18	15	13	13	12	12	11	11	16	21	23	19	35	43	45	45	37	28	24	****	****	22.6
31	32	19	16	11	11	9	5	5	13	17	19	26	31	33	40	44	46	44	36	31	28	18	****	****	24.3
MEAN	30.0	26.6	25.1	23.0	20.9	20.4	19.5	20.3	23.9	28.9	32.9	38.6	42.0	45.6	47.5	50.2	50.7	49.5	48.6	45.5	40.7	37.0	****	****	35.1

PERCENTAGE OF DATA VALID 88.7

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 23189.00 TOTAL MONTHLY RECORD HOURS = 660.00

TABLE: F-170

OWMC AIR POLLUTION SURVEY

OZONE

UNITS PPB

STATION LINCOLN COUNTY

MONTH AUG 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	18	22	24	18	14	19	22	37	40	20	20	20	20	20	20	28	20	28	28	20	20	20	****	****	22.6
2	16	16	8	12	8	8	4	4	20	20	4	32	4	4	4	4	44	48	60	48	40	40	****	****	20.4
3	20	20	20	12	16	16	12	12	16	20	28	28	32	36	36	32	32	36	28	24	20	20	****	****	23.5
4	8	12	16	16	16	12	8	12	20	24	28	28	28	36	32	32	36	40	40	36	32	32	****	****	24.7
5	28	20	12	16	20	20	16	16	20	32	40	48	56	56	56	****	****	****	60	48	44	40	****	****	34.1
6	40	28	28	40	28	20	16	16	24	32	48	52	60	64	68	68	80	80	56	68	64	56	****	****	47.1
7	24	28	32	64	60	56	48	48	44	40	40	40	48	48	56	48	44	40	40	32	40	28	****	****	43.1
8	32	36	40	72	24	48	28	24	36	44	40	56	48	46	56	58	62	66	76	71	62	46	****	****	48.7
9	32	28	24	24	20	20	16	16	24	24	32	36	40	40	40	40	40	40	32	28	24	20	****	****	29.1
10	24	24	28	28	20	20	12	12	16	20	24	24	24	28	28	24	24	40	40	36	40	32	****	****	25.8
11	24	24	24	24	28	28	24	20	20	20	20	24	28	28	32	31	32	39	36	31	22	17	****	****	26.2
12	8	7	4	4	1	3	5	3	13	22	25	27	28	30	30	36	35	36	37	37	33	26	****	****	20.5
13	14	13	14	6	10	8	7	2	15	23	34	33	43	48	53	56	54	53	51	44	28	24	****	****	28.8
14	20	15	12	12	17	22	21	24	20	24	58	59	57	57	58	70	71	65	64	58	56	53	****	****	41.5
15	46	43	39	35	35	29	22	19	23	30	42	55	72	79	79	70	65	37	38	47	33	30	****	****	44.0
16	33	36	33	35	38	32	25	23	24	28	36	40	44	52	56	56	56	53	53	56	46	38	****	****	40.6
17	39	37	34	30	27	24	23	19	22	30	38	43	43	****	44	49	50	50	55	42	46	47	****	****	37.7
18	25	21	19	19	19	18	15	14	****	****	****	****	29	30	32	30	33	35	31	25	14	18	****	****	23.7
19	29	24	21	25	13	13	****	****	****	****	****	****	****	****	****	****	****	****	41	39	35	24	****	****	****
20	12	16	12	16	16	24	24	24	32	40	52	56	64	76	76	80	76	72	68	60	48	52	****	****	45.3
21	24	28	32	28	28	36	40	28	36	44	48	56	56	28	28	48	72	80	76	68	56	48	****	****	44.9
22	28	36	28	28	28	24	20	20	24	24	24	32	32	36	40	40	40	40	36	28	24	16	****	****	29.5
23	4	8	8	8	8	12	20	44	44	56	64	64	72	72	68	64	68	60	32	28	36	32	****	****	39.6
24	24	24	24	24	24	24	24	20	24	32	36	36	36	40	40	40	40	40	40	36	16	20	****	****	30.2
25	16	8	12	12	4	4	4	4	8	12	24	32	33	38	40	44	44	40	40	44	44	40	****	****	24.9
26	18	12	16	16	16	20	24	20	24	40	52	64	74	84	96	100	100	92	84	72	64	60	****	****	52.2
27	69	52	44	48	48	36	24	24	20	24	24	28	24	28	24	32	36	28	28	28	24	24	****	****	32.6
28	24	20	12	8	8	8	4	8	16	24	28	36	36	36	32	32	32	36	36	36	28	24	****	****	23.8
29	15	14	11	12	13	15	16	15	26	29	33	37	40	43	46	48	48	50	54	55	52	45	****	****	32.6
30	30	26	25	23	22	16	24	18	27	39	47	42	45	55	63	67	70	76	76	66	61	52	****	****	44.1
31	20	10	20	20	18	18	21	17	25	57	65	71	74	80	83	86	89	90	76	68	59	55	****	****	51.0
MEAN	24.6	22.8	21.8	23.7	20.9	21.1	19.0	18.8	24.2	30.1	36.3	41.3	43.0	45.4	47.2	48.7	51.5	51.4	48.8	44.5	39.1	34.8	****	****	34.4

PERCENTAGE OF DATA VALID 89.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 22746.00 TOTAL MONTHLY RECORD HOURS = 662.00

TABLE: F-171

OWMC AIR POLLUTION SURVEY

OZONE

UNITS PPB

STATION LINCOLN COUNTY

MONTH SEP 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	57	46	33	24	15	16	16	19	34	59	71	62	89	92	91	91	92	95	93	90	70	50	****	****	59.3
2	42	41	32	25	28	21	10	8	17	38	58	84	95	97	100	101	113	121	115	93	73	67	****	****	62.7
3	46	42	42	42	35	29	23	16	23	29	60	67	65	68	76	79	81	85	65	44	40	39	****	****	49.8
4	27	30	28	29	26	27	30	29	28	28	43	36	38	32	37	38	41	40	41	39	36	32	****	****	33.4
5	29	33	37	34	22	22	19	17	22	28	33	36	42	48	49	50	47	46	47	51	49	45	****	****	36.6
6	32	19	15	16	13	8	7	8	18	30	39	45	47	48	50	48	49	47	43	40	33	27	****	****	31.0
7	32	31	21	15	14	9	7	10	15	28	32	32	36	39	41	42	43	40	39	35	25	20	****	****	27.5
8	12	11	10	13	12	9	5	2	15	26	37	43	47	48	47	50	50	54	59	57	53	48	****	****	32.2
9	49	44	41	37	36	33	31	25	26	36	45	37	56	60	69	76	79	80	75	64	54	34	****	****	49.4
10	26	40	32	29	30	37	36	37	44	42	38	44	38	33	27	36	41	52	47	43	47	62	****	****	39.1
11	55	54	50	46	46	34	36	37	37	36	34	34	35	37	37	42	46	44	45	42	39	39	****	****	41.1
12	31	34	31	28	28	27	24	21	20	22	16	16	16	20	21	22	26	29	32	31	27	26	****	****	24.9
13	17	15	18	15	15	15	14	13	17	24	30	35	34	32	34	38	39	37	34	30	27	24	****	****	25.3
14	16	10	8	7	4	4	4	4	7	12	18	24	28	30	31	32	29	30	28	26	22	17	****	****	17.8
15	6	11	14	10	9	4	3	5	7	10	14	18	19	15	4	9	12	14	9	15	8	12	****	****	10.4
16	18	17	14	10	9	7	8	9	14	18	21	24	27	28	34	34	34	30	26	20	16	10	****	****	19.5
17	12	10	8	6	4	2	0	0	4	6	18	26	28	36	40	42	48	56	48	38	30	26	****	****	22.2
18	2	3	6	18	22	20	20	16	12	16	24	20	28	32	36	32	28	****	****	****	****	****	****	****	19.7
19	****	****	****	****	****	****	****	****	****	****	****	4	22	28	31	32	32	29	22	16	13	12	****	****	****
20	8	12	14	18	8	4	10	8	6	4	4	6	8	8	10	12	12	12	12	12	10	6	****	****	9.3
21	6	6	6	6	6	6	6	6	6	8	8	8	10	11	12	14	16	16	16	12	10	10	****	****	9.3
22	4	2	2	4	4	4	4	4	2	4	4	11	14	12	****	****	22	24	28	26	10	0	****	****	9.3
23	22	16	20	****	4	8	12	12	12	12	12	12	16	18	****	****	****	34	30	24	19	18	****	****	16.7
24	12	10	6	4	4	2	3	2	0	2	8	16	24	32	36	40	46	44	42	48	40	32	****	****	20.6
25	16	6	2	0	0	2	0	0	0	6	12	16	34	32	12	24	22	22	20	24	16	6	****	****	12.4
26	0	0	0	0	0	2	4	3	8	8	10	16	28	32	30	28	23	22	20	20	22	16	****	****	13.3
27	15	17	20	20	16	16	15	14	16	12	14	15	16	18	20	19	18	18	16	12	14	12	****	****	16.0
28	10	12	10	11	12	12	12	12	11	10	10	11	16	20	****	****	****	****	****	****	****	****	****	****	12.1
29											DATA MISSING														
30											DATA MISSING														
MEAN	22.3	21.2	19.3	18.0	15.6	14.1	13.3	12.5	15.6	20.5	26.4	28.5	34.1	35.9	39.0	41.2	41.9	43.1	40.5	36.6	30.9	26.5	****	****	27.0

PERCENTAGE OF DATA VALID 81.4

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 15820.00 TOTAL MONTHLY RECORD HOURS = 586.00

TABLE: F-172

OWMC AIR POLLUTION SURVEY

OZONE

UNITS PPB

STATION LINCOLN COUNTY

MONTH OCT 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1																									
2											DATA MISSING														
3											DATA MISSING														
4											DATA MISSING														
5											DATA MISSING														
6											DATA MISSING														
7											DATA MISSING														
8											DATA MISSING														
9											DATA MISSING														
10											DATA MISSING														
10	20	18	23	22	21	19	20	17	15	21	24	26	28	28	28	29	27	26	20	15	11	10	****	****	21.3
11	1	3	6	5	5	8	9	9	13	19	20	27	29	29	29	33	38	36	30	22	15	15	****	****	18.2
12	30	31	28	29	27	25	23	21	25	27	26	30	33	33	33	37	37	32	30	26	26	25	****	****	28.8
13	25	24	21	19	16	14	13	11	10	9	9	7	10	14	19	25	24	23	20	17	12	10	****	****	16.0
14	7	5	4	4	6	6	5	8	8	14	16	15	14	12	12	9	11	16	22	17	16	29	****	****	11.6
15	15	13	15	17	19	19	18	16	16	18	20	23	22	22	23	23	24	22	17	16	14	13	****	****	18.4
16	7	8	8	8	8	9	16	17	16	23	26	28	26	29	32	31	29	28	24	18	15	28	****	****	19.7
17	0	0	0	2	4	0	0	3	8	12	12	17	22	25	18	30	30	27	23	23	21	38	****	****	14.3
18	18	18	13	2	0	0	0	0	2	6	13	22	22	26	26	29	29	27	23	23	9	10	****	****	14.5
19	2	5	2	2	0	0	0	4	9	12	25	38	44	48	50	51	46	45	46	41	39	34	****	****	24.7
20	23	23	25	23	20	16	15	18	14	22	29	43	60	66	55	57	62	62	53	53	53	43	****	****	38.0
21	37	41	42	38	31	19	21	24	28	29	33	40	39	35	42	49	50	49	43	41	35	33	****	****	36.3
22	11	12	10	6	4	4	4	4	15	28	37	40	47	60	65	63	50	48	****	51	48	45	****	****	31.0
23	****	****	****	****	****	****	****	****	****	****	35	43	45	41	39	29	29	25	19	12	7	3	****	****	27.3
24	7	7	4	7	10	10	8	9	12	19	25	26	28	30	32	31	29	25	20	17	11	2	****	****	16.8
25	9	12	16	13	12	11	12	9	9	10	13	15	15	16	17	17	15	18	21	15	3	2	****	****	12.7
26	7	7	9	10	12	12	12	11	7	6	9	14	19	20	19	17	14	11	9	3	2	2	****	****	10.5
27	2	3	2	2	2	2	2	4	6	12	18	23	20	24	23	22	22	16	15	13	12	13	****	****	11.7
28	22	19	19	21	23	23	21	18	19	21	25	30	36	26	40	36	39	41	42	40	36	31	****	****	28.5
29	33	33	35	35	33	31	30	30	33	38	39	38	36	36	32	29	24	21	16	19	16	14	****	****	29.6
30	13	10	17	19	16	15	20	22	22	24	20	17	21	21	21	20	19	13	8	9	3	4	****	****	16.1
31	1	1	1	1	2	3	8	9	14	20	28	29	31	33	34	34	29	20	20	29	29	28	****	****	18.4
MEAN	13.8	14.0	14.3	13.6	12.9	11.7	12.2	12.6	14.3	18.6	22.8	26.9	29.4	30.6	31.3	31.9	30.8	28.7	24.8	23.6	19.7	19.6	****	****	21.0

PERCENTAGE OF DATA VALID 63.6

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 9915.00 TOTAL MONTHLY RECORD HOURS = 473.00

TABLE: F-173

OWMC AIR POLLUTION SURVEY

OZONE

UNITS PPB

STATION LINCOLN COUNTY

MONTH NOV 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	25	25	25	23	24	24	22	23	24	24	30	34	29	46	50	54	52	49	24	21	18	22	****	****	30.4
2	16	21	28	32	30	25	22	24	31	34	27	39	36	37	37	36	36	34	28	25	20	16	****	****	28.8
3	6	4	5	6	6	10	8	9	10	21	24	27	31	34	36	35	32	38	35	28	32	32	****	****	21.3
4	20	19	16	14	14	33	34	26	28	31	30	31	34	34	35	31	28	24	20	17	13	12	****	****	24.7
5	10	10	13	11	18	17	20	18	16	20	22	****	****	****	****	****	****	****	****	****	****	****	****	****	****
6											DATA MISSING														
7	****	****	****	****	****	****	****	****	****	****	****	****	9	5	6	5	2	1	1	1	2	1	****	****	****
8	2	2	2	1	2	2	1	4	8	10	9	10	11	12	16	19	23	22	18	19	19	18	****	****	10.5
9	28	30	25	27	29	34	31	30	30	29	33	34	31	35	33	34	35	31	30	31	31	31	****	****	31.0
10	29	29	29	29	27	27	27	27	27	27	30	30	19	30	32	31	28	24	17	14	11	7	****	****	25.0
11	0	3	5	12	21	17	15	15	14	14	11	12	17	25	23	19	20	16	17	15	19	22	****	****	15.1
12	23	18	18	22	20	19	20	21	21	10	10	14	10	15	18	****	****	21	20	22	19	17	****	****	17.9
13	35	33	32	34	33	32	30	29	28	26	31	31	34	34	34	35	35	32	30	29	28	24	****	****	31.3
14	22	22	23	23	22	23	22	25	30	27	24	16	29	30	31	31	33	34	31	28	24	22	****	****	26.0
15	10	9	8	17	18	16	17	20	19	19	20	20	9	16	21	23	23	21	23	26	25	21	****	****	18.2
16	10	5	1	1	3	4	7	10	11	11	11	12	11	13	12	12	9	7	2	7	9	7	****	****	8.0
17	12	16	20	19	16	19	19	16	13	22	19	22	22	23	27	23	24	19	14	17	17	19	****	****	19.0
18	11	7	7	6	4	4	15	17	20	21	29	32	32	31	25	29	30	28	31	30	32	28	****	****	21.3
19	22	32	40	42	40	39	35	29	31	32	36	39	39	40	****	****	29	26	19	20	12	13	****	****	30.8
20	12	15	12	16	19	18	15	15	20	21	22	20	10	15	20	19	****	****	1	1	1	6	****	****	13.9
21	1	2	7	12	15	18	17	12	20	23	28	32	34	38	38	34	32	29	29	20	18	16	****	****	21.6
22	11	11	11	9	11	8	9	9	12	21	28	27	27	6	29	33	25	17	13	11	10	8	****	****	15.7
23	9	6	5	1	1	14	18	19	20	21	23	26	26	25	26	24	18	16	22	21	20	17	****	****	17.2
24	11	8	8	14	24	21	19	19	19	22	23	22	22	20	19	18	17	****	****	****	18	18	****	****	18.0
25	13	12	10	9	10	12	12	12	13	16	17	19	23	20	20	20	14	9	7	6	3	2	****	****	12.7
26	1	0	0	0	1	1	1	1	1	2	2	7	12	13	15	8	10	7	1	1	2	9	****	****	4.3
27	6	5	4	5	6	10	7	8	9	11	16	21	****	****	32	22	27	32	31	25	22	20	****	****	15.9
28	26	19	26	21	18	15	12	8	4	6	20	****	****	****	****	****	33	15	19	16	14	10	****	****	16.6
29	6	13	14	12	6	5	5	4	6	6	9	16	20	20	22	19	22	19	22	23	17	5	****	****	13.2
30	20	23	18	24	23	21	22	25	26	27	27	27	28	27	27	26	26	26	23	22	21	20	****	****	24.0
MEAN	14.2	14.3	14.7	15.8	16.5	17.4	17.2	17.0	18.3	19.8	21.8	23.8	23.3	24.8	26.3	25.6	25.5	23.0	19.6	18.4	17.0	15.8	****	****	19.4

PERCENTAGE OF DATA VALID 83.2

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 11629.00 TOTAL MONTHLY RECORD HOURS = 599.00

TABLE: F-174 OWMC AIR POLLUTION SURVEY

OZONE UNITS PPB

STATION LINCOLN COUNTY MONTH DEC 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	20	23	29	28	29	30	29	25	27	27	27	27	****	****	23	21	17	15	13	15	12	12	****	****	22.5
2	15	16	13	20	23	21	18	20	19	16	16	6	6	8	6	4	4	7	15	15	15	14	****	****	13.5
3	14	14	10	9	6	4	4	4	6	5	4	4	3	4	10	12	****	****	****	18	19	21	****	****	9.0
4	26	27	25	26	27	28	25	27	28	26	26	27	27	28	26	25	27	26	23	21	20	18	****	****	25.4
5	23	24	22	22	21	21	20	20	20	22	22	23	25	****	24	25	23	24	28	21	22	24	****	****	22.7
6	21	18	17	19	16	15	15	11	12	13	11	9	12	11	9	7	5	3	2	1	0	1	****	****	10.4
7	0	0	0	0	2	3	1	3	9	11	14	23	17	19	17	13	17	12	9	5	3	2	****	****	8.2
8	3	3	11	20	28	31	32	32	26	28	29	28	29	28	27	26	25	****	26	25	21	****	****	15	23.5
9	15	14	12	10	8	8	7	5	3	3	3	3	2	2	1	1	0	0	0	0	0	****	****	8	4.8
10	11	11	7	9	11	11	16	23	22	23	24	24	24	22	20	****	20	20	19	16	14	****	****	8	16.9
11	10	11	11	9	9	8	8	7	5	11	17	17	19	19	20	18	7	3	6	5	3	****	****	6	10.4
12	4	8	15	16	17	17	14	15	18	20	24	28	30	31	32	33	30	32	30	31	31	****	****	29	23.0
13	27	29	28	25	22	16	18	19	22	28	28	33	36	36	37	37	35	34	28	23	23	****	****	27	27.8
14	22	27	25	25	23	22	18	14	18	18	16	19	25	27	25	13	19	16	18	17	19	****	****	12	19.9
15	13	12	14	14	14	14	14	12	14	17	19	19	11	20	****	****	****	****	13	12	12	****	****	10	14.1
16	11	12	9	7	6	5	3	2	2	5	7	8	8	6	3	3	0	0	0	0	0	****	****	0	4.4
17	0	0	0	0	0	0	0	0	0	0	2	5	6	5	9	12	****	****	****	****	****	****	****	****	2.4
18											DATA MISSING														
19											DATA MISSING														
20											DATA MISSING														
21											DATA MISSING														
22	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	21	****
23	19	21	18	11	17	21	17	12	12	14	15	15	15	12	8	8	5	7	6	8	8	****	****	4	12.4
24	3	10	12	15	10	4	4	14	16	16	18	18	17	20	20	19	18	16	13	12	12	****	****	15	13.7
25	16	16	16	12	11	10	8	8	9	11	13	17	21	25	30	31	28	27	28	27	26	****	****	27	19.0
26	26	27	26	27	26	26	26	27	27	27	26	25	26	25	24	22	20	18	17	15	13	****	****	12	23.1
27	11	12	13	14	14	13	11	12	16	12	14	14	11	13	16	20	20	17	14	11	12	****	****	11	13.7
28	10	13	13	12	13	15	18	19	18	19	17	20	23	23	22	11	5	12	13	10	5	****	****	13	14.7
29	12	11	12	11	10	10	7	6	7	10	12	14	14	14	15	16	13	8	1	1	1	****	****	2	9.4
30	0	0	0	0	0	0	0	0	0	3	7	9	10	3	1	7	11	14	13	1	2	****	****	18	4.5
31	19	22	27	26	24	23	24	18	15	15	15	23	22	24	26	20	17	16	14	15	14	****	****	19	19.9
MEAN	13.5	14.7	14.8	14.9	14.9	14.5	13.7	13.7	14.3	15.4	16.4	17.6	17.6	17.7	18.0	16.8	15.9	14.9	14.5	13.0	12.3	****	****	13.5	15.1

PERCENTAGE OF DATA VALID 74.6 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 8376.00 TOTAL MONTHLY RECORD HOURS = 555.00

TABLE: F-175

OWMC AIR POLLUTION SURVEY

OZONE

UNITS PPB

STATION LINCOLN COUNTY

MONTH JAN 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	20	19	19	19	19	17	10	19	22	19	18	20	22	24	22	13	12	13	14	11	8	****	****	8	16.7
2	7	6	9	17	20	21	25	27	28	30	33	34	34	34	33	33	24	21	17	19	22	****	****	20	23.4
3	10	14	17	20	25	29	28	26	27	26	28	31	39	41	40	39	37	30	28	27	23	****	****	16	27.3
4	13	10	8	9	11	13	14	17	21	20	21	26	30	34	36	34	25	20	11	4	5	****	****	4	17.5
5	2	7	4	1	1	1	1	1	5	11	17	22	34	43	46	48	44	37	27	20	19	****	****	6	18.0
6	4	1	2	5	10	12	15	14	16	16	19	25	24	25	20	17	14	6	10	15	12	****	****	12	13.4
7	14	15	15	17	16	15	14	9	8	9	14	19	20	21	21	19	23	22	26	27	22	****	****	28	17.9
8	30	29	30	31	29	25	25	26	29	28	29	32	30	28	26	25	23	21	18	21	17	****	****	22	26.1
9	22	21	22	20	19	21	22	19	19	21	22	23	23	20	11	19	20	17	14	10	4	****	****	2	17.8
10	2	8	11	9	7	7	6	6	8	9	9	13	15	15	20	18	12	9	9	7	5	****	****	5	9.5
11	5	1	1	1	1	3	8	14	19	21	25	27	31	33	34	34	35	34	31	29	28	****	****	24	20.0
12	27	28	27	26	24	22	21	21	22	22	24	27	28	29	31	31	32	28	28	26	33	****	****	36	27.0
13	37	35	34	36	37	38	36	35	34	34	37	39	39	39	39	39	35	29	28	22	20	****	****	5	33.0
14	18	24	21	17	8	10	10	4	13	17	19	24	26	24	19	25	26	22	22	8	12	****	****	11	17.3
15	10	12	12	13	7	9	9	9	9	9	11	11	12	20	27	31	29	25	24	23	23	****	****	36	16.9
16	37	38	38	38	41	41	39	35	38	35	35	36	37	36	35	33	29	27	27	27	25	****	****	24	34.1
17	22	26	30	29	23	24	22	25	33	33	24	32	29	31	33	33	32	31	30	27	24	****	****	12	27.5
18	12	12	13	13	16	13	14	14	13	13	12	12	12	18	18	23	27	26	26	26	26	****	****	24	17.4
19	20	20	22	24	24	23	19	16	19	25	31	34	35	34	32	34	33	29	32	37	37	****	****	33	27.9
20	27	13	15	22	27	26	25	25	26	29	34	36	41	45	38	40	41	40	41	43	37	****	****	34	32.0
21	28	27	29	30	28	26	30	23	19	23	30	34	38	38	30	34	30	23	34	38	37	****	****	33	30.1
22	33	33	33	26	25	30	30	28	26	27	27	27	26	26	25	23	18	19	17	12	5	****	****	4	23.6
23	10	5	3	1	12	35	36	37	37	37	38	29	40	40	39	38	38	37	36	35	35	****	****	31	29.5
24	32	35	36	34	37	33	29	29	31	35	37	38	40	42	41	41	39	33	34	40	40	****	****	27	35.6
25	27	31	30	30	29	29	30	31	32	34	35	39	40	42	44	44	41	41	38	34	31	****	****	****	34.9
26	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	24	24	47	****	****	****	****	****	****
27	****	****	****	****	****	****	****	****	****	****	****	31	34	34	30	35	35	28	30	31	31	****	****	29	****
28	28	23	14	12	9	9	13	8	15	16	15	22	24	23	23	****	****	37	27	20	16	****	****	29	19.1
29	30	36	36	34	32	33	32	30	29	31	38	41	43	45	43	40	****	****	4	11	18	****	****	12	30.9
30	12	15	10	28	32	31	32	29	23	17	15	16	17	17	17	15	10	6	15	17	19	****	****	29	19.2
31	28	26	25	25	28	27	29	31	33	34	35	36	39	41	40	41	40	38	35	32	32	****	****	24	32.7
MEAN	19.6	19.7	19.5	20.2	20.6	21.5	21.5	21.0	22.6	23.5	25.2	27.9	30.1	31.4	30.4	31.0	28.6	25.8	25.2	23.3	22.2	****	****	20.0	24.2

PERCENTAGE OF DATA VALID 87.0

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 15627.00 TOTAL MONTHLY RECORD HOURS = 647.00

TABLE F-176

OWMC AIR POLLUTION SURVEY

OZONE

UNITS PPB

STATION LINCOLN COUNTY

MONTH FEB 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	21	24	21	21	19	23	27	29	30	33	31	32	33	32	34	34	31	25	24	25	22	****	****	13	26.5
2	15	16	16	13	10	4	12	12	15	20	22	23	26	25	24	21	20	20	21	19	25	****	****	25	18.4
3	23	8	5	13	15	17	16	12	12	16	16	19	23	30	35	36	35	31	32	32	****	****	****	35	22.0
4	35	36	38	38	37	36	36	36	36	36	39	37	39	40	42	43	36	31	30	31	29	****	****	30	36.0
5	30	30	29	28	27	26	27	24	28	32	35	35	25	30	31	23	38	37	28	18	14	****	****	17	27.8
6	16	14	14	12	11	9	7	7	13	15	18	26	29	27	30	32	33	11	15	15	15	****	****	19	17.6
7	17	19	19	18	17	17	21	22	24	26	28	33	39	40	39	40	35	35	33	32	32	****	****	29	28.0
8	28	29	29	30	29	28	22	22	23	23	22	24	32	31	30	29	28	30	30	32	31	****	****	29	27.8
9	31	34	33	33	33	32	29	28	28	22	24	31	38	39	42	43	41	39	34	31	27	****	****	3	31.6
10	2	2	10	24	22	22	22	21	22	24	****	****	****	****	****	****	****	32	34	27	26	****	****	18	20.5
11	19	15	16	18	21	21	22	19	16	21	24	26	31	36	37	35	36	35	30	23	19	****	****	24	24.7
12	16	6	1	1	2	2	8	16	17	21	30	33	39	37	****	27	19	12	15	29	27	****	****	31	18.5
13	33	33	33	33	34	34	32	27	30	30	30	31	33	34	34	34	33	27	21	13	13	****	****	6	28.5
14	5	6	21	29	29	30	24	22	23	28	26	26	27	30	31	30	29	27	26	17	21	****	****	22	24.0
15	25	30	32	33	33	30	28	28	25	26	28	30	26	26	28	30	27	26	23	20	17	****	****	26	27.1
16	29	25	28	27	27	25	25	22	21	25	29	30	26	24	29	26	25	20	17	16	22	****	****	21	24.5
17	22	18	17	7	10	10	16	20	23	30	35	36	39	40	40	37	30	29	27	22	24	****	****	10	24.6
18	8	12	9	11	15	19	22	19	20	26	34	35	36	34	33	35	28	11	3	8	12	****	****	4	19.7
19	10	13	14	14	10	7	9	5	10	16	22	30	34	36	34	42	40	34	29	27	23	****	****	19	21.7
20	16	11	4	4	8	4	1	2	9	15	23	30	37	40	40	42	40	31	24	24	23	****	****	12	20.0
21	13	12	11	12	12	12	14	13	9	18	24	29	31	33	34	33	31	19	12	11	8	****	****	7	18.1
22	3	1	1	1	1	1	2	2	7	15	18	23	23	25	27	24	22	19	37	31	28	****	****	42	16.0
23	46	49	48	40	33	32	14	19	18	18	22	20	23	25	30	****	****	****	35	36	35	****	****	29	30.1
24	29	30	28	27	26	23	21	19	18	23	24	27	33	32	32	31	32	32	32	33	21	****	****	16	26.8
25	20	14	17	15	17	13	8	6	9	19	20	21	26	25	29	30	29	27	17	17	11	****	****	8	18.1
26	1	3	1	1	1	6	4	9	17	19	20	25	28	27	27	22	23	17	14	11	9	****	****	7	13.3
27	8	10	11	9	9	1	0	4	12	19	25	23	24	25	25	25	22	18	13	11	8	****	****	1	13.8
28	1	2	3	0	0	16	22	23	28	20	10	21	30	27	18	15	19	17	12	9	14	****	****	****	14.6
MEAN	18.6	17.9	18.2	18.3	18.1	17.9	17.5	17.4	19.4	22.7	25.1	28.0	30.7	31.5	32.1	31.5	30.1	25.6	23.9	22.1	20.6	****	****	18.6	22.9

PERCENTAGE OF DATA VALID 89.7

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 13801.00 TOTAL MONTHLY RECORD HOURS = 603.00

TABLE: F-177

OWMC AIR [illegible]

OZONE

UNITS [illegible]

STATION LINCOLN COUNTY

MONTH MAR 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	22	19	19	21	20	16	17	18	19	18	20	33	20	19	20	24	32	31	23	5	7	****	****	8	19.1
2	12	8	17	24	25	26	28	34	36	38	37	37	39	40	40	41	42	41	40	39	36	****	****	33	32.4
3	30	29	30	29	29	31	34	39	37	37	****	****	****	****	****	****	****	****	****	23	****	****	****	27	31.3
4	27	27	23	19	21	18	15	13	16	17	24	25	****	****	27	30	35	34	34	33	31	****	****	29	24.9
5	30	28	26	26	23	21	21	21	23	25	30	30	29	****	****	31	32	29	25	26	17	****	****	6	25.0
6	6	2	2	1	2	4	5	8	13	19	23	23	24	25	27	20	16	15	9	7	12	****	****	14	12.6
7	13	15	18	15	13	10	14	18	23	30	36	38	44	52	58	61	64	56	72	56	58	****	****	63	37.6
8	50	50	52	43	40	40	33	42	44	46	57	71	90	94	91	92	98	97	75	55	47	****	****	28	60.7
9	33	33	44	38	31	29	34	36	36	35	33	33	36	36	39	40	38	38	34	34	33	****	****	31	35.2
10	31	33	31	34	36	39	41	43	43	41	43	40	39	41	43	46	44	44	41	34	30	****	****	34	38.7
11	24	14	12	4	1	1	6	22	23	33	39	40	40	41	40	40	36	33	23	28	27	****	****	19	24.8
12	18	13	13	12	11	8	6	6	11	17	20	25	23	27	36	43	44	39	38	36	35	****	****	22	22.9
13	19	17	15	18	20	20	18	23	30	31	34	35	34	40	40	44	41	40	36	35	33	****	****	17	29.1
14	15	15	13	11	12	12	9	12	20	28	29	33	34	31	35	36	35	36	38	38	38	****	****	34	25.6
15	30	28	31	33	31	30	29	30	34	38	44	52	50	44	45	49	51	50	50	38	27	****	****	17	37.8
16	20	24	25	27	35	34	33	30	36	41	45	46	47	52	56	57	57	47	36	41	36	****	****	29	38.8
17	24	19	22	23	24	22	25	25	30	33	41	47	47	50	51	51	49	46	43	31	34	****	****	23	34.5
18	23	20	20	20	20	20	18	25	29	39	39	45	51	56	56	55	55	55	51	51	46	****	****	18	36.9
19	22	13	7	4	1	1	4	24	28	29	35	41	43	45	46	45	47	50	43	31	20	****	****	18	27.1
20	13	13	14	19	22	25	26	29	28	28	31	39	44	47	47	44	49	48	43	38	37	****	****	33	32.6
21	29	32	34	28	13	4	12	22	30	34	39	42	45	45	45	46	45	42	37	35	32	****	****	25	32.5
22	28	24	28	29	30	30	29	29	32	35	38	39	42	43	42	45	46	44	36	24	24	****	****	15	33.3
23	17	22	24	17	17	13	10	15	28	32	41	47	37	40	78	50	50	40	35	25	25	****	****	15	30.8
24	15	15	15	15	12	6	12	16	25	35	42	49	53	45	48	42	38	36	35	33	26	****	****	20	28.8
25	35	36	40	43	45	44	40	34	31	34	38	40	44	47	50	44	42	46	45	47	46	****	****	37	41.3
26	40	31	33	29	25	24	24	24	23	25	22	19	17	30	28	24	18	17	16	15	14	****	****	10	23.1
27	7	7	7	7	5	6	9	11	12	15	15	18	25	28	32	35	38	32	10	5	0	****	****	0	14.7
28	0	0	0	0	4	6	5	6	12	20	30	42	43	47	44	44	47	46	42	42	34	****	****	6	23.6
29	5	4	2	1	1	3	8	13	27	35	42	52	44	51	55	57	53	40	30	25	10	****	****	52	27.7
30	49	50	51	52	53	51	49	47	45	44	39	31	13	10	15	17	15	16	6	9	13	****	****	29	32.0
31	30	31	31	31	30	30	31	31	32	33	33	32	35	38	37	36	34	34	33	32	31	****	****	36	32.8
MEAN	23.1	21.7	22.5	21.7	21.0	20.1	20.8	24.1	27.6	31.1	34.6	37.8	39.0	41.6	43.8	43.0	43.0	40.7	36.0	31.3	28.6	****	****	24.1	30.6

PERCENTAGE OF DATA VALID 89.8

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 20448.00 TOTAL MONTHLY RECORD HOURS = 668.00

TABLE: F-178

OWMC AIR POLLUTION SURVEY

OZONE

UNITS PPB

STATION LINCOLN COUNTY

MONTH APR 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	37	38	38	36	36	35	32	29	29	37	38	40	44	48	52	56	55	52	46	41	37	****	****	33	40.4
2	34	35	34	35	34	35	31	34	37	38	39	38	38	38	40	****	****	41	41	39	39	****	****	37	36.8
3	36	35	36	36	35	34	34	34	37	39	42	44	45	47	48	48	49	48	44	39	29	****	****	32	39.6
4	31	39	29	29	33	36	39	39	39	39	39	39	40	41	42	42	43	42	43	44	44	****	****	44	38.9
5	45	44	43	41	39	38	36	35	39	42	39	37	36	35	35	39	43	49	49	47	45	43	****	****	40.9
6	43	43	42	42	40	38	37	37	37	34	34	36	36	37	35	35	38	37	36	39	39	38	****	****	37.9
7	11	18	15	19	21	25	27	29	30	28	29	38	40	45	46	50	48	47	39	34	35	36	****	****	32.3
8	30	29	28	27	28	28	27	25	24	24	26	29	32	36	40	41	42	33	31	36	34	****	****	20	30.5
9	13	13	15	15	16	15	12	12	17	30	37	43	46	49	47	45	45	45	43	42	39	****	****	38	30.8
10	41	41	40	40	40	40	38	30	27	31	36	39	37	44	54	62	65	60	58	60	54	****	****	30	44.0
11	23	24	26	22	33	28	29	33	38	47	56	50	47	46	54	63	65	58	63	55	49	****	****	42	43.2
12	39	35	33	29	29	27	28	27	22	13	21	30	28	30	39	49	48	43	41	39	41	****	****	51	33.7
13	51	46	48	32	24	29	29	28	28	31	35	37	37	****	****	****	****	****	****	41	38	****	****	16	34.4
14	20	27	21	16	16	17	22	17	31	45	54	59	51	43	50	51	47	46	45	42	35	****	****	27	35.5
15	27	22	19	22	25	26	22	19	17	43	46	46	46	30	28	49	53	47	42	41	46	****	****	41	34.4
16	40	41	46	48	45	42	39	40	45	47	41	31	43	46	44	49	48	47	51	54	45	****	****	48	44.5
17	45	43	42	38	32	31	23	25	27	31	30	31	30	30	32	33	34	34	34	35	35	****	****	29	32.9
18	26	23	19	16	16	20	22	24	23	24	34	44	48	48	52	55	55	53	52	52	47	****	****	36	35.9
19	41	39	36	39	42	40	37	40	46	48	49	50	53	60	57	56	54	53	52	47	44	****	****	47	46.8
20	43	42	41	45	44	36	35	25	28	35	36	40	52	60	65	64	62	62	60	54	45	****	****	28	45.5
21	20	9	1	0	20	27	23	13	17	****	****	51	70	77	72	72	83	81	77	66	29	****	****	26	41.7
22	29	31	32	32	33	34	33	33	32	32	32	33	33	33	36	38	40	40	38	34	29	****	****	32	33.6
23	29	25	25	27	29	30	26	20	25	42	48	46	32	21	23	19	16	14	14	12	10	****	****	8	24.6
24	23	28	30	25	27	32	35	36	36	34	36	39	40	41	43	44	45	45	37	37	32	****	****	25	35.0
25	27	32	36	33	27	24	26	29	33	36	42	42	42	43	45	46	46	45	44	37	34	****	****	31	36.4
26	42	43	36	32	32	31	30	30	30	34	40	45	45	53	50	51	50	51	47	40	32	****	****	31	39.8
27	26	20	22	23	27	25	20	23	33	49	52	56	62	57	61	65	57	67	50	37	38	****	****	30	40.9
28	30	29	40	35	34	32	33	32	33	33	32	32	31	31	32	30	****	****	28	28	27	****	****	24	31.3
29	24	23	19	18	18	23	19	19	25	29	33	39	37	41	52	53	52	50	****	****	46	****	****	32	32.6
30	32	32	30	28	29	28	25	25	25	27	29	34	37	39	42	****	****	44	44	42	39	****	****	28	33.0
MEAN	31.9	31.6	30.7	29.3	30.1	30.2	29.0	28.1	30.3	35.2	38.1	40.6	41.9	43.1	45.4	48.3	49.3	47.6	44.6	41.9	37.9	****	****	32.1	37.0

PERCENTAGE OF DATA VALID 89.4

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 23812.00 TOTAL MONTHLY RECORD HOURS = 644.00

TABLE: F-179

OWMC AIR POLLUTION SURVEY

OZONE

UNITS PPB

STATION LINCOLN COUNTY

MONTH MAY 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	29	26	27	24	22	17	18	21	32	44	48	51	54	56	47	56	57	60	55	53	49	****	****	37	40.1
2	42	47	45	45	41	38	39	31	30	36	42	44	49	53	55	59	58	60	59	53	44	****	****	35	45.7
3	19	25	25	23	23	24	28	35	39	39	38	38	40	45	46	46	48	50	50	46	38	****	****	33	36.3
4	38	38	37	33	22	26	31	33	34	34	35	38	39	42	47	51	52	52	51	47	39	****	****	39	39.0
5	41	38	36	28	15	17	15	24	29	34	42	46	48	52	58	61	64	65	64	54	46	****	****	39	41.6
6	41	34	29	23	27	19	15	21	29	37	47	54	54	55	****	****	68	74	77	76	74	****	****	72	46.3
7	55	47	38	32	27	26	35	36	34	37	42	44	49	54	55	57	57	57	54	55	46	****	****	31	44.0
8	31	30	28	19	13	12	17	17	25	46	52	53	53	56	57	56	55	54	56	50	45	****	****	54	40.0
9	56	56	47	41	42	42	43	41	40	43	34	35	43	52	65	67	61	62	67	70	65	****	****	79	52.3
10	70	60	60	60	58	58	53	53	50	54	65	75	78	85	90	90	88	90	93	85	85	****	****	45	70.2
11	55	50	53	53	56	60	58	60	59	59	65	74	51	62	65	102	101	95	91	88	71	****	****	76	68.4
12	71	53	36	33	27	28	27	****	****	****	****	****	****	****	****	45	52	55	51	49	47	****	****	27	42.9
13	22	11	13	13	13	19	16	19	36	41	45	51	49	53	59	63	61	61	59	54	45	****	****	30	37.9
14	32	56	56	53	51	46	42	43	44	46	49	53	64	79	91	98	98	97	95	85	****	****	****	****	63.9
15	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	41	40	34	30	21	22	****	****	13	****
16	9	6	5	7	5	2	4	11	19	26	33	38	38	43	48	54	62	57	53	49	48	****	****	43	30.0
17	47	47	52	46	38	30	27	29	34	43	50	54	****	****	****	****	****	****	****	****	****	****	****	****	41.4
18	86	77	71	53	44	40	29	27	28	25	25	22	26	30	31	31	28	30	26	25	27	****	****	22	36.5
19	22	19	21	22	24	25	24	24	23	23	25	30	34	37	37	39	36	29	25	23	19	****	****	31	26.9
20	26	23	20	18	19	23	27	34	35	34	35	36	38	41	44	45	44	44	43	40	31	****	****	26	33.0
21	22	27	29	27	26	25	25	23	22	18	19	30	50	65	72	77	80	54	45	35	25	****	****	38	37.9
22	29	33	29	30	27	25	23	23	25	26	37	44	58	50	45	54	61	77	64	69	67	****	****	68	43.8
23	66	63	56	44	37	29	24	26	30	33	33	37	35	38	39	38	39	35	34	32	26	****	****	26	37.3
24	25	20	15	13	11	11	10	17	23	26	28	28	29	28	27	26	27	30	26	21	21	****	****	16	21.7
25	11	9	6	6	9	9	8	16	22	23	27	27	29	33	33	37	42	42	41	40	29	****	****	23	23.7
26	19	20	22	23	22	22	20	15	13	12	11	13	14	22	52	68	51	35	34	27	29	****	****	46	26.8
27	41	39	34	29	25	22	19	21	24	27	33	42	57	64	66	68	70	72	73	73	70	****	****	64	47.0
28	66	61	51	41	42	39	38	35	37	43	54	64	76	88	89	85	79	81	86	86	82	****	****	60	62.9
29	53	53	48	45	45	40	35	35	42	54	68	82	90	92	98	99	99	102	101	106	98	****	****	64	70.4
30	65	60	62	73	72	61	49	44	52	65	72	78	88	98	99	94	93	96	96	87	84	****	****	75	75.6
31	69	61	60	64	59	56	55	54	47	46	44	43	45	50	62	67	70	68	68	64	61	****	****	47	57.3
MEAN	41.9	39.6	37.0	34.0	31.4	29.7	28.5	29.9	33.0	37.0	41.3	45.7	49.2	54.4	58.4	61.2	61.4	60.6	58.9	55.4	49.4	****	****	43.4	44.5

PERCENTAGE OF DATA VALID 86.7

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 28720.00 TOTAL MONTHLY RECORD HOURS = 645.00

TABLE F-180

Summary of Nitrogen Oxide Levels at OWMC Preferred Site (ppb)
June 1986 to May 1987

Month	Mean			Maximum Hourly Value			Minimum Hourly Value		
	NO	NO_2	NO_x	NO	NO_2	NO_x	NO	NO_2	NO_x
1986									
June	2.5	4.8	5.7	9	30	36	0	0	0
July	1.3	4.0	5.6	8	30	40	0	0	0
August	0.3	2.8	2.7	40	33	40	0	0	0
Sept.	0.9	6.0	7.0	18	30	55	0	0	0
Oct.	1.3	11.3	11.3	18	35	44	0	0	0
Nov.	2.5	13.2	14.5	88	54	133	0	0	0
Dec.	3.7	16.5	19.7	119	42	160	0	0	0
1987									
Jan.	2.1	15.9	19.1	31	57	76	0	3	2
Feb.	2.4	16.4	18.9	41	50	90	0	1	1
March	2.3	15.3	16.6	24	57	67	0	2	2
April	1.6	11.8	13.9	13	38	41	0	3	3
May	1.8	11.4	11.8	20	43	63	0	4	4
Summer	1.4	3.9	4.7	40	33	40	0	0	0
Fall	1.6	10.1	10.8	88	54	133	0	0	0
Winter	2.7	16.2	19.2	119	57	160	0	0	0
Spring	1.9	12.8	14.1	24	57	67	0	2	2
Annual	1.9	11.0	12.3	119	57	160	0	0	0

TABLE F-181

Summary of Ozone Levels at Preferred OWMC Site (ppb)
June 1986 to May 1987

Month	Mean	Maximum Hourly Value	Minimum Hourly Value	No. of Criterion Exceedances
1986				
June	23.7	88	0	5
July	35.1	99	0	15
August	34.4	100	1	10
September	27.0	121	0	19
October	21.1	65	0	0
November	19.4	54	0	0
December	15.1	37	0	0
1987				
January	24.2	48	1	0
February	22.9	49	0	0
March	30.6	98	0	6
April	37.0	83	0	2
May	44.5	106	2	46
Summer	31.5	100	0	30
Fall	22.5	121	0	19
Winter	21.0	49	0	0
Spring	37.3	106	0	54
Annual	28.4	121	0	103

Note:

Ontario Air Quality Criterion
1-Hr Average 80 ppb

TABLE: F-182

OWMC AIR POLLUTION SURVEY

TRS

UNITS PPB

STATION LINCOLN COUNTY

MONTH JUN 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1											DATA MISSING														
2	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0	0	0	0	0	0	0	0	0	****
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
4	0	1	0	0	0	1	0	0	0	0	0	0	0	****	0	0	0	0	0	0	0	0	0	0	0.1
5	0	0	0	0	0	0	0	0	0	0	****	0	0	0	0	0	1	0	0	0	0	1	0	****	0.1
6	0	0	0	1	0	1	0	1	1	1	0	****	****	****	0	1	1	1	0	0	0	0	0	0	0.4
7	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	****	0.3
8	1	0	0	1	1	1	1	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	****	0.3
9	0	0	0	1	0	0	0	0	0	0	0	0	0	0	****	0	0	0	0	0	0	0	0	****	0.0
10	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
12	1	1	1	1	1	1	2	2	1	0	0	0	0	0	1	1	1	1	1	1	0	0	0	****	0.7
13	0	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	0	0	****	0.4
14	0	0	****	1	2	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	0	0	****	0.3
15	0	0	0	0	0	1	0	1	2	3	2	1	0	0	0	0	0	0	0	0	0	0	0	****	0.4
16	1	1	1	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	1	1	0	0	0	****	0.3
17	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.1
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
19	0	0	1	1	1	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	1	1	****	0.4
20	1	1	1	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	1	****	0.3
21	1	2	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	1	0	****	0.6
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	****	0.2
23	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	****	0.4
24	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	****	****	****	****	****	****	****	****	0.9
25	****	****	****	****	****	****	****	****	****	****	****	****	3	2	2	2	1	0	0	0	0	0	0	****	****
26	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	****	1.0
27	****	****	****	****	****	****	****	****	****	****	****	****	0	0	0	0	0	0	0	0	0	0	0	****	****
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
30	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	****	****	0.1
MEAN	0.3	0.4	0.4	0.5	0.4	0.3	0.3	0.4	0.4	0.3	0.3	0.2	0.3	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.3	0.3	0.2	****	0.3

PERCENTAGE OF DATA VALID 85.8

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 188.00 TOTAL MONTHLY RECORD HOURS = 618.00

TABLE: F-183

OWMC AIR POLLUTION SURVEY

TRS

UNITS PPB

STATION LINCOLN COUNTY

MONTH JUL 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	****	****	****	****	****	****	****	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	****	0.3
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	****	0.2
6	4	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	****	0.3
7	0	0	0	0	0	1	0	2	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	****	0.6
8	1	0	0	0	1	1	2	2	5	4	1	1	1	1	2	2	2	2	1	2	2	2	2	****	1.6
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0	****	0.2
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
11	0	0	0	0	0	0	****	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.1
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
13	1	****	****	0	****	****	****	****	****	****	****	****	0	0	0	0	0	0	0	0	0	0	0	****	0.1
14	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
15	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.2
16	1	1	1	1	1	1	1	0	0	1	1	1	0	0	1	0	0	0	0	0	0	1	1	****	0.6
17	1	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	****	0.2
18	4	2	****	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.3
19	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.1
20	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
21	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
22	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	****	0	0	0	0	0	0	0	****	0.1
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
27	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
28	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
MEAN	0.7	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.2	0.2	****	0.2

PERCENTAGE OF DATA VALID 93.1

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 114.00 TOTAL MONTHLY RECORD HOURS = 693.00

TABLE: F-184

OWMC AIR POLLUTION SURVEY

TRS

UNITS PPB

STATION LINCOLN COUNTY

MONTH AUG 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	1	0	0	0	0	0	0	0	0	0	****	****	0	0	0	0	0	0	0	0	0	0	****	****	0.1
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
4	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	****	****	0.1
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	1	1	1	1	1	****	****	0.3
6	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
7	2	2	1	1	1	2	2	1	1	1	0	1	0	0	0	0	0	0	1	0	0	0	****	****	0.2
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.6
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
10	2	2	2	2	2	1	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	****	0.6
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	****	0.2
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
19	0	0	0	0	0	0	0	****	****	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
22	4	2	1	2	2	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
23	1	0	0	0	0	0	1	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	****	0.4
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
25	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.2
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
27	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
28	1	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.2
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
31	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.1
MEAN	0.5	0.2	0.2	0.2	0.3	0.2	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2	****	0.1

PERCENTAGE OF DATA VALID 93.7

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 86.00 TOTAL MONTHLY RECORD HOURS = 697.00

TABLE: F-185

OWMC AIR POLLUTION SURVEY

TRS

UNITS PPB

STATION LINCOLN COUNTY

MONTH SEP 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.1
2	0	0	2	1	1	1	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.4
3	1	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.3
4	1	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	****	0.2
5	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	.	0	0	0	0	****	0.3
6	1	1	1	0	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	****	0.4
7	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	1	2	1	1	1	1	****	0.5
8	2	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	0	0	1	1	1	1	****	0.9
9	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	****	0.6
10	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	****	1.0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
12	2	2	1	1	1	2	2	2	2	2	1	1	1	1	1	1	0	0	1	1	1	1	2	****	1.3
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
14	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.3
15	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	0	1	0	0	0	0	0	****	0.3
16	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.4
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
25	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.2
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	****	0.0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	****	0.1
30	0	0	0	****	****	****	****	****	****	****	****	****	****	0	****	****	****	****	****	****	****	****	0	****	0.0
MEAN	0.3	0.3	0.4	0.3	0.4	0.4	0.4	0.4	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3	****	0.2

PERCENTAGE OF DATA VALID 93.2

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 165.00 TOTAL MONTHLY RECORD HOURS = 671.00

TABLE: F-186

OWMC AIR POLLUTION SURVEY

TRS

UNITS PPB

STATION LINCOLN COUNTY

MONTH OCT 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
2	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0	0	0	0	0	0	0	0	0	****	****
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
5	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.1
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	****	0.0
10	1	1	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	****	0.3
11	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	****	0.2
12	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
13	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	****	0.1
14	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.1
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	****	0.1
16	1	0	1	1	1	1	1	1	1	0	0	0	0	0	1	1	1	0	1	1	1	1	1	****	0.7
17	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	****	0.5
18	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	****	1.0
19	3	1	1	2	2	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.6
20	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	****	0.2
21	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
23	****	****	****	****	****	****	****	****	****	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	****	0.0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	****	****	0.1
26	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	****	0.2
31	2	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.2
MEAN	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.2	0.2	0.3	0.3	****	0.2

PERCENTAGE OF DATA VALID 92.2

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 105.00 TOTAL MONTHLY RECORD HOURS = 696.00

TABLE: F-187 OWMC AIR POLLUTION SURVEY

TRS UNITS PPB

STATION LINCOLN COUNTY MONTH NOV 1986

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
2	1	1	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.2
3	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.1
4	1	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	1	1	1	0	0	0	****	0.3
5	1	1	1	1	1	0	1	1	0	****	****	1	1	1	1	1	1	1	1	1	****	****	****	****	0.9
6	DATA MISSING																								
7	****	****	****	****	****	****	****	****	****	****	****	****	1	1	1	1	1	1	1	1	1	1	1	****	****
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0	0	0	0	0	0	****	0.0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
14	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	****	0.0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	****	0	0	0	0	0	0	****	0.0
20	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0	0	0	0	0	****	0.0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0	0	0	0	****	0.0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	****	0.0
29	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
MEAN	0.3	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	****	0.1

PERCENTAGE OF DATA VALID 89.3 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 47.00 TOTAL MONTHLY RECORD HOURS = 643.00

TABLE: F-188

OWMC AIR POLLUTION SURVEY

TRS

UNITS PPB

STATION LINCOLN COUNTY

MONTH DEC 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	2	2	1	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.4
2	0	0	0	0	0	0	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	****	0.7
3	2	1	1	1	1	1	1	1	2	2	1	2	2	1	0	0	0	0	0	0	0	0	0	****	0.8
4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	****	1.0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0	0	0	0	0	0	0	0	****	0.0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0	0	0	0	0	****	0.0
9	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	0	0	****	0.2
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0	0	0	0	0	****	0.0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
13	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
14	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
15	2	2	2	2	2	2	2	2	2	2	2	2	2	2	****	****	****	****	****	****	****	****	****	****	2.0
16	DATA MISSING																								
17	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	1	1	1	1	1	****	****
18	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	****	1.0
19	0	0	0	0	0	0	0	0	0	0	****	****	****	0	0	0	0	0	0	0	0	0	0	****	0.0
20	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	1	1	1	1	****	0.3
21	1	0	1	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1	1	1	1	1	1	****	0.5
22	1	0	0	0	1	0	0	0	0	****	****	****	****	0	0	1	1	1	1	0	0	0	0	****	0.3
23	1	1	0	0	0	0	0	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1	0	****	0.6
24	1	1	1	1	0	1	1	1	1	1	1	0	0	0	0	1	0	1	1	0	0	****	****	****	0.6
25	****	****	****	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
27	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.1
28	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	****	0.1
29	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
30	1	0	0	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.3
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
MEAN	0.6	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.3	0.1	0.3	0.4	0.3	0.3	0.3	0.2	****	0.3

PERCENTAGE OF DATA VALID 86.8

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 192.00 TOTAL MONTHLY RECORD HOURS = 646.00

TABLE: F-189 OWMC AIR POLLUTION SURVEY

TRS UNITS PPB

STATION LINCOLN COUNTY MONTH JAN 1987

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
2	1	1	1	1	1	1	1	2	2	2	1	1	1	2	2	1	0	0	0	0	0	0	0	****	0.9
3	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	1	1	0	****	0.3
4	2	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	****	0.7
5	1	0	0	0	0	0	1	1	1	2	1	1	0	0	0	0	0	0	0	0	0	0	0	****	0.3
6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
7	0	0	1	1	1	1	1	0	1	1	1	1	0	0	0	1	1	1	1	0	0	0	0	****	0.6
8	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	****	****	0	****	****	0.7
9	****	****	****	****	****	****	****	****	****	****	****	****	0	0	0	0	0	0	0	0	0	0	****	****	****
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
12	0	0	0	0	1	0	0	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	****	****	0.3
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	0.0
16	1	0	0	0	0	0	1	1	0	1	1	1	1	1	0	0	1	1	1	1	1	0	0	****	0.6
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
19	0	0	0	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	****	0.2
20	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.1
21	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1	0	0	****	0.2
22	1	0	1	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	1	1	1	0	0	****	0.5
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
24	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.1
25	2	1	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.3
26	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
27	1	1	1	1	1	1	1	1	2	1	****	0	0	0	0	0	0	0	0	0	0	0	0	****	0.5
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
MEAN	0.5	0.1	0.2	0.2	0.2	0.2	0.3	0.4	0.4	0.4	0.3	0.3	0.1	0.2	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.0	0.0	****	0.2

PERCENTAGE OF DATA VALID 92.7 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 144.00 TOTAL MONTHLY RECORD HOURS = 690.00

TABLE: F-190

OWMC AIR POLLUTION SURVEY

TRS

UNITS PPB

STATION LINCOLN COUNTY

MONTH FEB 1987

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
3	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	1	0	0	0	0	****	****	****	0.2
4	2	2	1	2	1	1	2	2	2	2	2	1	2	1	1	1	1	0	0	0	0	0	0	****	1.1
5	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	****	0.1
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
9	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
10	1	0	0	0	0	0	0	0	****	****	****	****	****	0	0	0	0	0	1	1	1	0	0	****	0.2
11	1	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	1	0	0	0	0	0	****	0.3
12	0	0	1	1	1	1	1	1	1	1	1	1	1	1	****	0	0	0	0	0	0	0	0	****	0.5
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
14	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
15	2	1	0	0	0	0	0	0	1	1	1	0	0	0	1	0	0	1	1	1	1	0	0	****	0.5
16	3	1	1	0	1	1	0	1	1	1	0	0	1	1	0	0	****	****	0	0	0	0	0	****	0.6
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
18	1	0	0	0	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.3
19	1	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	****	0.3
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
22	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.1
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
24	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
25	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
26	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	****	0.2
27	1	1	0	1	0	0	0	1	1	1	0	0	0	0	0	0	0	1	1	1	1	1	1	****	0.5
28	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	****	****	0.4
MEAN	0.6	0.2	0.1	0.2	0.2	0.2	0.1	0.3	0.4	0.4	0.2	0.1	0.2	0.2	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.0	****	0.2

PERCENTAGE OF DATA VALID 94.2

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 123.00 TOTAL MONTHLY RECORD HOURS = 633.00

TABLE: F-191

OWMC AIR POLLUTION SURVEY

TRS

UNITS PPB

STATION LINCOLN COUNTY

MONTH MAR 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	1	0	0	0	0	1	0	1	0	1	1	1	0	0	1	1	0	1	1	0	0	0	0	****	0.4
2	1	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	****	0.2
3	0	0	0	0	0	0	1	0	1	0	****	****	****	****	****	****	****	****	0	0	0	0	0	****	0.1
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
8	0	0	0	0	0	0	0	0	0	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	****	0.1
10	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.1
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
12	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
14	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.1
15	1	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.2
16	1	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.2
17	1	0	0	0	0	0	0	0	0	0	0	1	****	1	0	0	0	0	0	0	0	0	0	****	0.1
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
19	1	0	1	0	0	0	0	0	0	****	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.1
20	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
22	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
23	1	1	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	****	0.3
24	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.1
25	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	1	1	0	0	0	****	0.3
26	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	****	0.2
27	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	1	0	0	1	0	0	****	0.2
28	1	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1	0	0	1	0	0	0	1	****	0.3
29	1	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	****	0.2
30	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	****	0.0
31	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	****	0.1
MEAN	0.5	0.1	0.1	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.1	0.0	0.1	****	0.1

PERCENTAGE OF DATA VALID 92.6

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 78.00 TOTAL MONTHLY RECORD HOURS = 689.00

TABLE: F-192 OWMC AIR POLLUTION SURVEY

TRS UNITS PPB

STATION LINCOLN COUNTY MONTH APR 1987

HOUR DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	1	0	1	0	1	1	1	0	0	1	0	0	1	1	1	0	0	0	0	0	0	0	0	****	0.4
2	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	****	****	1	1	1	1	1	1	****	0.3
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
5	0	0	0	0	1	1	1	1	1	1	1	0	0	0	1	1	0	1	0	1	1	0	1	0	0.5
6	****	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.0
7	****	1	1	1	1	1	1	0	1	0	0	0	0	1	0	1	1	1	0	1	1	1	1	1	0.7
8	****	1	1	1	1	1	1	1	1	0	0	1	1	1	0	****	0	1	1	1	1	1	1	****	0.8
9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	0	1	1	****	0.7
10	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	0	1	0	0	1	1	****	0.8
11	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	0	1	1	****	0.9
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	****	1.0
13	1	1	1	1	1	1	1	1	****	****	****	****	****	****	1	1	1	1	1	1	1	1	1	****	1.0
14	1	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	0	0	1	0	****	0.5
15	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	****	0.9
16	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	1	****	0.6
17	1	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	1	1	****	0.3
18	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	1	0	****	0.7
19	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	0	1	1	1	1	1	****	0.9
20	1	1	0	1	1	1	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	1	****	0.6
21	0	0	0	0	0	0	0	0	0	0	****	****	1	1	0	0	0	0	0	0	0	0	0	****	0.1
22	0	0	0	0	0	0	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	****	0.6
23	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	2	1	2	1	****	1.0
24	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	****	0	0	0	0	****	0.9
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
27	1	0	0	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.3
28	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	****	****	****	0	0	0	0	0	****	0.0
29	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	****	****	****	****	1	0	0	****	0.2
30	2	2	0	0	0	2	0	2	0	2	0	0	0	0	****	****	****	0	0	0	0	0	0	****	0.5
MEAN	0.7	0.6	0.5	0.6	0.7	0.7	0.6	0.7	0.6	0.6	0.5	0.5	0.5	0.6	0.4	0.4	0.4	0.5	0.5	0.4	0.4	0.6	0.6	****	0.5

PERCENTAGE OF DATA VALID 92.2 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 364.00 TOTAL MONTHLY RECORD HOURS = 664.00

TABLE: F-193

OWMC AIR POLLUTION SURVEY

TRS

UNITS PPB

STATION LINCOLN COUNTY

MONTH MAY 1987

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
4	0	****	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	****	****	****	0	0	0	0	0	****	0.0
6	1	1	1	1	1	0	0	1	0	0	0	0	0	0	****	****	0	0	0	0	0	0	0	****	0.3
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
8	1	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.3
9	1	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	****	0.2
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
11	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	****	0	0	0	****	****	0	0	****	0.2
12	2	2	2	2	1	1	1	1	1	1	1	1	****	****	****	0	0	0	0	0	0	1	1	****	0.9
13	2	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	****	0.6
14	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	****	****	****	****	0.9
15	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0	0	0	0	0	0	0	0	****	****
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
17	1	0	0	0	0	1	1	1	1	1	1	1	****	****	****	****	****	****	****	****	****	****	****	****	0.7
18	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	****	0.1
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
20	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	****	0.1
21	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	0	0	1	****	0.2
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	****	0.1
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
28	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.0
29	2	2	2	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	****	0.5
30	1	1	0	0	0	0	0	1	1	0	0	0	1	1	0	1	0	1	1	0	0	0	1	****	0.4
31	1	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	****	0.2
MEAN	0.5	0.3	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.0	0.1	0.1	****	0.2

PERCENTAGE OF DATA VALID 90.2

**** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 117.00 TOTAL MONTHLY RECORD HOURS = 671.00

TABLE F-194

Summary of Total Reduced Sulphur Levels at OWMC Preferred Site (ppb)
June 1986 to May 1987

Month	Mean	Maximum Hourly Values	Minimum Hourly Values
1986			
June	0.3	3	0
July	0.2	4	0
August	0.1	4	0
September	0.2	2	0
October	0.2	3	0
November	0.1	1	0
December	0.3	2	0
1987			
January	0.2	2	0
February	0.2	3	0
March	0.1	2	0
April	0.5	2	0
May	0.2	2	0
Summer	0.2	4	0
Fall	0.2	3	0
Winter	0.2	3	0
Spring	0.3	2	0
Annual	0.2	4	0

TABLE: F-195 OWMC AIR POLLUTION SURVEY

TOTAL HYDROCARBON UNITS PPHM

STATION LINCOLN COUNTY MONTH AUG 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1											DATA MISSING														
2											DATA MISSING														
3											DATA MISSING														
4											DATA MISSING														
5											DATA MISSING														
6											DATA MISSING														
7											DATA MISSING														
8											DATA MISSING														
9											DATA MISSING														
10											DATA MISSING														
11											DATA MISSING														
12											DATA MISSING														
13											DATA MISSING														
14											DATA MISSING														
15	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	149	149	149	149	****	****
16	126	111	126	104	119	111	111	111	111	111	119	119	****	****	141	134	119	126	134	134	104	89	74	****	115.9
17	111	163	149	149	134	119	104	119	141	141	149	156	141	156	163	171	171	171	171	171	171	****	****	****	148.6
18	****	****	****	****	****	****	****	****	****	****	****	****	****	****	134	149	156	126	134	126	134	111	126	****	****
19	134	111	134	134	119	111	111	119	97	97	82	74	82	89	97	104	104	104	104	97	97	111	89	****	104.4
20	214	197	197	214	214	205	239	222	180	154	137	111	111	137	137	137	128	120	111	94	94	111	171	****	158.0
21	342	214	180	222	214	205	180	188	162	137	137	128	128	162	180	171	154	137	145	154	171	107	137	****	172.0
22	188	188	171	171	171	180	180	188	171	171	171	162	162	162	145	154	145	137	145	145	162	162	154	****	164.6
23	197	197	222	222	239	265	257	222	222	222	171	197	214	205	154	171	188	180	154	154	180	180	162	****	198.9
24	180	180	180	180	180	171	171	171	171	162	162	162	154	154	145	145	145	145	145	145	197	197	145	****	164.7
25	205	257	282	239	239	308	231	214	214	231	145	120	120	120	120	120	111	128	145	188	188	248	154	****	188.1
26	257	257	239	239	239	239	222	214	222	205	197	188	188	197	205	214	239	239	188	128	128	103	103	****	202.2
27	162	120	128	128	145	154	162	171	171	180	197	188	180	180	188	188	197	205	205	205	205	205	180	****	175.8
28	205	188	205	231	214	205	214	231	222	197	188	188	197	188	188	180	180	180	180	180	171	180	145	****	193.8
29	214	231	299	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
30											DATA MISSING														
31											DATA MISSING														
MEAN	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	165.6

PERCENTAGE OF DATA VALID 38.7 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 47707.00 TOTAL MONTHLY RECORD HOURS = 288.00

TABLE: F-196 OWMC AIR POLLUTION SURVEY

TOTAL HYDROCARBON UNITS PPBM

STATION LINCOLN COUNTY MONTH OCT 1986

HOUR / DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1											DATA MISSING														
2	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	156	139	142	137	201	142	138	156	****	****
3	186	180	192	192	184	120	134	132	102	90	90	102	115	108	126	126	122	126	115	130	180	144	154	****	137.0
4	168	187	198	175	170	164	166	163	172	166	162	164	162	158	145	151	137	138	144	146	146	146	162	****	160.4
5	180	190	179	179	189	191	193	217	215	206	200	194	194	185	185	186	178	174	171	175	169	157	145	****	184.9
6	166	166	168	163	158	158	157	154	167	160	151	144	144	168	180	194	176	155	158	150	142	154	252	****	164.6
7	173	144	158	158	160	158	161	158	152	109	85	95	104	106	113	117	137	154	178	192	217	221	210	****	150.4
8	223	218	203	194	200	180	168	179	173	185	194	188	194	194	193	184	180	192	193	202	193	168	160	****	189.5
9	177	174	161	140	130	117	121	129	125	127	131	133	148	127	133	137	129	147	160	153	138	143	161	****	140.9
10	160	162	172	166	143	149	142	151	158	149	150	154	148	144	144	148	151	149	146	170	185	180	170	****	156.1
11	230	262	235	245	252	226	226	258	246	187	180	190	191	191	191	189	180	182	203	218	226	240	193	****	214.8
12	162	181	185	190	186	165	163	170	175	168	170	158	152	160	163	168	175	182	196	183	179	161	170	****	172.3
13	175	174	168	158	155	142	151	165	201	201	194	183	176	166	164	169	165	167	168	164	163	166	166	****	169.6
14	178	188	194	175	174	168	169	158	156	170	171	167	170	179	198	190	175	163	172	191	177	168	188	****	175.6
15	152	185	145	143	166	150	145	150	168	144	141	145	146	150	152	164	165	163	165	182	178	162	171	****	157.9
16	240	279	223	211	225	212	209	228	225	182	190	172	164	164	150	142	142	144	149	176	292	186	202	****	196.0
17	182	212	207	218	221	202	232	230	230	195	174	161	155	161	162	172	168	161	166	193	184	186	220	****	191.0
18	200	206	222	245	289	309	294	280	285	251	245	215	202	205	207	****	****	****	****	****	****	****	****	****	243.7
19	****	****	****	****	****	****	****	****	****	****	****	220	235	248	252	270	259	259	257	242	259	245	228	****	247.8
20	****	****	****	****	****	****	****	****	****	****	****	****	****	****	191	166	154	157	165	163	175	167	174	****	****
21	224	187	175	194	178	209	211	207	186	174	154	116	110	117	112	97	100	121	****	****	****	****	****	****	159.6
22	****	****	****	****	****	****	****	****	****	145	165	198	188	193	216	209	233	240	222	224	204	204	176	****	201.2
23	167	152	153	178	163	187	165	178	184	184	172	166	152	157	153	152	147	176	155	164	153	163	187	****	165.6
24	178	198	198	189	189	242	243	219	194	171	158	143	134	132	141	128	129	128	134	149	160	178	194	****	170.8
25	178	160	160	165	157	152	154	160	162	174	169	178	187	193	193	169	150	121	105	110	154	210	194	****	163.3
26	171	163	174	166	163	134	130	130	176	202	199	178	198	175	152	143	146	154	164	169	174	174	171	****	165.5
27	171	172	176	250	277	230	226	227	231	198	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
28											DATA MISSING														
29											DATA MISSING														
30											DATA MISSING														
31											DATA MISSING														
MEAN	183.7	188.2	183.9	186.1	187.7	180.2	180.0	183.8	185.6	171.2	165.7	163.7	163.9	164.4	167.3	163.6	159.9	162.3	166.2	176.0	182.2	176.6	182.8	****	174.8

PERCENTAGE OF DATA VALID 70.3 **** - INSUFFICIENT DATA AVAILABLE

TOTAL MONTHLY SUM= 91398.00 TOTAL MONTHLY RECORD HOURS = 523.00

TABLE F-197

OWMC Preferred Site

Total Suspended Particle (TSP) and
Fine Particle (FP) Concentrations* ($\mu g/m^3$)
June 1986 to May 1987

Date	TSP	FP	% Fine
1986			
June 1	47	25	53
June 4	NA	43	NA
June 7	59	52	89
June 10	54	33	61
June 13	21	16	75
June 16	50	34	68
June 19	NA	87	NA
June 22	NA	46	NA
June 25	36	13	35
June 28	40	27	66
July 1	23	NA	NA
July 4	37	23	62
July 7	66	43	66
July 10	25	15	58
July 13	32	24	76
July 16	25	21	81
July 19	32	15	49
July 22	41	31	75
July 25	102	87	85
July 28	NA	38	NA
July 31	33	17	51
August 3	21	16	76
August 6	NA	36	NA
August 9	22	16	74
August 12	27	16	59
August 15	62	52	84
August 18	45	23	50
August 21	51	NA	NA
August 24	11	7	66
August 27	19	8	43
August 30	39	27	69
September 2	62	48	77
September 5	37	32	86
September 8	29	15	52
September 11	39	37	95
September 14	NA	NA	NA
September 17	19	15	78
September 20	44	37	83
September 23	21	17	82
September 26	37	32	86
September 29	NA	26	NA

TABLE F-197 (cont'd)

OWMC Preferred Site

Total Suspended Particle (TSP) and
Fine Particle (FP) Concentrations* ($\mu g/m^3$)
June 1986 to May 1987

Date	TSP	FP	% Fine
October 2	19	17	86
October 5	10	7	72
October 8	29	22	79
October 11	25	20	77
October 14	15	13	86
October 17	10	NA	NA
October 20	32	29	91
October 23	47	37	78
October 26	30	27	90
October 29	34	25	75
November 1	NA	NA	NA
November 4	14	7	53
November 7	31	25	81
November 8	43	15	35
November 10	17	NA	NA
November 13	8	8	100
November 13	NA	8	NA
November 16	NA	30	NA
November 16	53	33	62
November 19	NA	13	NA
November 19	NA	14	NA
November 22	33	31	92
November 22	28	28	100
November 25	NA	32	NA
November 28	26	24	95
December 1	NA	19	NA
December 4	12	11	96
December 7	22	19	86
December 10	22	21	95
December 13	18	13	72
December 16	56	56	100
December 19	24	20	84
December 22	30	30	99
December 25	NA	20	NA
December 28	26	26	100
December 31	24	21	89

TABLE F-197 (cont'd)

OWMC Preferred Site

Total Suspended Particle (TSP) and
Fine Particle (FP) Concentrations* ($\mu g/m^3$)
June 1986 to May 1987

Date	TSP	FP	% Fine
1987			
January 3	NA	19	NA
January 6	29	28	96
January 9	24	23	97
January 12	NA	16	NA
January 15	14	14	100
January 18	24	24	100
January 21	NA	21	NA
January 24	14	6	38
January 27	56	44	78
January 30	24	23	95
February 2	39	30	76
February 5	18	15	83
February 8	15	15	97
February 8	16	NA	NA
February 11	23	9	40
February 14	30	19	61
February 17	32	22	68
February 20	36	NA	NA
February 23	46	46	100
February 26	44	34	77
March 1	17	14	82
March 4	NA	17	NA
March 7	59	49	83
March 10	15	5	35
March 13	30	22	73
March 16	26	19	75
March 19	35	24	69
March 22	22	15	71
March 25	32	23	71
March 27	NA	37	NA
March 31	8	10	130
April 3	25	15	59
April 6	11	10	90
April 9	25	17	67
April 12	21	NA	NA
April 15	36	27	76
April 18	18	17	94
April 21	71	44	63
April 24	28	10	37
April 27	34	23	67
April 30	32	11	35

TABLE F-197 (cont'd)

OWMC Preferred Site

Total Suspended Particle (TSP) and
Fine Particle (FP) Concentrations* ($\mu g/m^3$)
June 1986 to May 1987

Date	TSP	FP	% Fine
May 3	41	16	40
May 6	91	45	49
May 9	123	56	46
May 12	42	22	53
May 15	43	16	38
May 18	34	23	67
May 21	36	28	77
May 24	26	22	87
May 27	53	NA	NA

Mean blank = -1.07 $\mu g/m^3$

TABLE F-197 (cont'd)

OWMC Preferred Site

Total Suspended Particle (TSP) and
Fine Particle (FP) Concentrations* ($\mu g/m^3$)
June 1986 to May 1987

Date	TSP	FP	% Fine
Arithmetic Mean (Summer)	39	31	78
Geometric Mean (Summer)	35	26	73
Arithmetic Mean (Fall)	29	23	80
Geometric Mean (Fall)	26	21	80
Arithmetic Mean (Winter)	28	23	82
Geometric Mean (Winter)	25	21	81
Arithmetic Mean (Spring)	36	23	63
Geometric Mean (Spring)	30	20	66
Arithmetic Mean (Annual)	33	25	75
Geometric Mean (Annual)	29	22	75

Notes:

*Blanks have been subtracted
NA - not available due to missing data

TABLE F-198

OWMC Preferred Site

Summary of Chlorides and Fluorides Concentrations* ($\mu g/m^3$)
June 1986 to May 1987

Date	Chlorides Total	Fluorides Particulate	Fluorides Gaseous	Fluorides Total
1986				
June 13	.10	.22	.08	.30
July 1	nd	.07	nd	.07
July 19	.34	nd	nd	nd
August 6	.94	.16	nd	.15
August 24	nd	nd	nd	nd
September 11	nd	nd	nd	nd
September 29	.51	.35	nd	.34
October 17	.17	.32	nd	.31
November 4	.78	.43	1.02	1.46
1987				
January 6	1.05	nd	nd	nd
January 15	nd	nd	nd	nd
January 24	1.25	.11	nd	.09
February 2	.18	nd	nd	nd
February 11	1.52	nd	nd	nd
February 20	1.59	nd	nd	nd
March 10	1.11	nd	.04	nd
March 28	.66	nd	nd	nd
April 15	.37	nd	.05	.02
May 3	1.55	nd	.02	nd
May 21	1.28	nd	nd	nd
Mean Blank	0.46			.08
Detection Limit	<.032			<.016

Notes:

* Blanks have been subtracted
nd - not detected

TABLE F-199

OWMC Preferred Site

Summary of Total Mercury Concentrations* (ng/m^3)
June 1986 to May 1987

Date	Mercury Concentration
1986	
June 13	nd
July 1	nd
July 19	nd
August 6	nd
August 24	nd
September 11	nd
September 29	nd
October 17	nd
November 4	1.9
1987	
January 6	nd
January 15	nd
January 24	nd
February 2	1.5
February 11	nd
February 20	nd
March 10	nd
March 28	2.3
April 15	20.5
May 3	1.5
May 21	3.9
Mean Blank	.88
Detection Limit	1.4

Notes:

* Blanks have been subtracted
nd - not detected

TABLE F-200

Summary of Polychlorinated Biphenol (PCB) Concentrations* (ng/m^3) at the OWMC Preferred Site (1986-1987)

PCB Congener	Aug. 28 1986	Sept. 11	Oct. 2	Nov. 4	Jan. 6 1987	Jan. 15	Jan. 24	Feb. 2	Feb. 11	Feb. 20	Mar. 10	Mean Blank
2-mono	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
22' + 26												nd
25 + 24												.003
23'												.006
23 + 24'												.012
22'5											.002	.002
24'6											nd	.011
24'5 + 22'46												.026
22'56'+ABC												.018
CC												.004
DD												.030
22'4'5												.012
D+22'3'5												.011
EE												.007
2345												.004
22'3,56+E												.007
22'33'6+V												nd
XX												
22'44'5+H												
22'3'45												
22'345'										.072		
Unknown										nd		
33'44'												
22'344'6+K												
233'44'						.01						
22'3455'+N						nd						
22'344'5'												
22'33'44'		.008										
233'44'5		.004										
22'33'44'5		nd		.045				.045	.049	.001	.002	.010
Total	nd	.012	nd	.045	nd	.01	nd	.045	.049	.073	.004	.17

Detection Limit <.009 ng/m^3

Notes: March 28 sampling results are not reported due to analytical problems.
*Blanks have been subtracted. nd - not detected.

TABLE F-201

OWMC Preferred Site

Summary of Chlorobenzene Concentrations* (ng/m^3) (1986-1987)

Chlorobenzene	Aug.28 1986	Sep.11	Oct.2	Nov.4	Jan.6 1987	Jan.15	Jan.24	Feb.2	Feb.11	Feb.20	Mar.10	Mar.28	Mean Blank
1,2-Di	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1,3-Di	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1,4-Di	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1,3,5-Tri	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.01
1,2,4-Tri	0.91	0.51	0.49	0.61	0.63	0.65	1.19	0.04	1.48	1.84	nd	1.06	0.2
1,2,3-Tri	.005	0.04	0.04	0.17	0.22	0.18	0.34	nd	0.46	0.51	nd	nd	0.07
1,2,3,5/ 1,2,4,5-Tetra	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.01
1,2,3,4-Tetra	.004	nd	nd	nd	nd	0.11	nd	nd	nd	nd	0.05	nd	0.01
Penta	0.02	0.04	0.05	0.06	0.06	0.06	0.04	0.04	0.06	0.07	0.03	0.21	0.01
Hexa	0.05	0.06	0.05	0.09	0.07	0.08	0.07	0.05	0.07	0.07	0.05	0.16	0.01

Detection Limits - 0.05 ng/m^3 for the di-chlorobenzenes
and - 0.005 ng/m^3 for the tri-, tetra-, penta- and hexa-chlorobenzenes

Notes:
*Blanks have been subtracted
nd - not detected.

TABLE F-202

OWMC Preferred Site

Chlorophenol Concentrations ($\mu g/m^3$) (1986-1987)

	2,3-Di	2,3,4-Tri	2,3,4,6-Tetra	Penta
Aug. 28 1986				
Sep. 11				
Oct. 2				
Nov. 4		None Detected		
Jan. 6 1987				
Jan. 15				
Jan. 24				
Feb. 2				
Feb. 11				
Feb. 20				
Mar. 10				
Mar. 28				
Mean Blank		None Detected		
Detection Limit	<.10	<.005	<.005	<.005

Note:
24-hr average air quality objective for pentachlorophenol is 30 $\mu g/m^3$

TABLE F-203

OWMC Preferred Site
Organochlorine Pesticide Concentrations* (ng/m^3) (1986-1987)

	Aug.28 1986	Sep.11	Oct.2	Nov.4	Jan.6 1987	Jan.15	Jan.24	Feb.2	Feb.11	Feb.20	Mar.10	Mar.28	Mean Blanks
p,p'-DDE**	-	-	-	-	-	-	-	-	-	-	-	-	-
p,p'-DDT	.024	nd	.017	nd	nd	.017	nd	nd	.010	nd	nd	nd	0.030
p,p'-DDD	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dieldrin	.011	.046	.144	.025	nd	.027	nd	.015	nd	nd	nd	.107	0.018
Endrin	nd	.014	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.007
HCH-α (BHC)	nd	.094	.007	nd	.061	.016	nd	nd	nd	nd	nd	nd	0.011
HCH-β	.013	.019	nd	nd	.030	.019	nd	.015	.012	.028	0.15	.024	nd
HCH-υ	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Chlordane-α	.008	nd	.085	nd	nd	.008	nd	nd	nd	nd	nd	nd	0.013
Chlordane-υ	nd	.067	.015	nd	nd	.011	nd	.010	nd	nd	nd	nd	0.005
Hepta chlorepoxide	nd	.029	.012	nd	nd	.010	nd	.010	nd	nd	nd	.058	nd
Methoxychlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Mirex	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

Mean Detection Limit .0049 ng/m^3

Notes:

* Blanks have been subtracted
** One of the PCB peaks coincided with DDE and, consequently, DDE was not quantified
nd- not detected

TABLE F-204

OWMC Preferred Site

Chlorinated Phenoxyacid Herbicide Concentrations* ($\mu g/m^3$) (1986-1987)

	2,4-D	2,4,5-T
1986		
August 28	nd	nd
Sept. 11	nd	nd
Oct. 2	nd	nd
Nov. 4	nd	nd
1987		
Jan. 6	nd	nd
Jan. 15	nd	nd
Jan. 24	nd	nd
Feb. 2	nd	nd
Feb. 11	nd	nd
Feb. 20	nd	nd
Mar. 10	nd	nd
Mar. 28	nd	.04
Mean Blank	nd	.03
Detection Limit	<.01	<.01

Note:

*Blanks have been subtracted
nd - not detected

TABLE F-205

OWMC Preferred Site

Dioxins and Furan Concentrations* (pg/m^3) (1986)

	Aug. 28 (1986)	Sept. 14	Oct. 2	Detection Limit	Mean Blank
Dioxin					
Tetrachlorodibenzo(p)	nd	nd	nd	.05	nd
Pentachlorodibenzo(p)	nd	nd	nd	.05	nd
Hexachlorodibenzo(p)	nd	nd	nd	.05	nd
Heptachlorodibenzo(p)	nd	nd	nd	.05	nd
Octachlorodibenzo(p)	nd	nd	.39	.10	0.55
Furan					
Tetrachlorodibenzo	.22	nd	nd	.05	0.18
Pentachlorodibenzo	nd	nd	nd	.05	nd
Hexachlorodibenzo	nd	nd	nd	.05	nd
Heptachlorodibenzo	nd	nd	nd	.05	nd
Octachlorodibenzo	nd	nd	nd	.10	nd

Notes:

nd - not detected
* Blanks have been subtracted from values reported.

TABLE F-206

OWMC Preferred Site
PAH Concentrations* (ng/m^3)
(June 1986 to May 1987)

Date	F	B(a)A	B(b)F	B(k)F	B(a)P	Dibenz (ah)A	Benz (ghi) Per	Indeno (1,2,3-od)Py	Fluorene	Phenan-threne	Anthra-cene	Pyrene
1986												
June 13	0.02	0.04	0.04	0.02	0.01	0.01	0.01	0.02	2.68	11.8	0.86	15.6
July 1	0.01	nd	0.07	0.03	0.05	0.01	0.07	0.11	14.2	21.0	3.80	44.5
July 19	0.02	0.03	0.02	0.02	0.02	nd	0.02	0.02	15.5	12.6	2.84	4.89
August 6	0.11	0.13	0.03	0.02	0.04	nd	0.03	0.02	7.26	14.9	2.41	nd
August 24	0.06	0.15	0.09	0.05	0.11	0.07	0.28	0.16	nd	9.12	1.56	15.6
Sept. 11	1.03	nd	0.02	0.01	0.004	nd	nd	nd	nd	4.31	nd	nd
Sept. 29	0.62	0.20	0.16	0.06	0.02	0.003	0.31	0.31	nd	11.0	0.24	1.48
October 17	0.53	0.01	0.12	0.03	nd	nd	nd	nd	nd	2.15	15.6	nd
November 6	0.54	0.03	0.10	0.04	0.01	0.02	0.10	0.14	nd	5.51	0.14	nd
1987												
January 6	1.02	0.30	0.60	0.22	0.49	0.09	0.55	0.71	nd	12.8	0.37	4.21
January 15	0.46	0.01	0.10	0.04	0.02	nd	0.04	0.07	nd	6.39	0.08	2.57
January 24	0.35	0.02	0.14	0.05	0.04	nd	0.10	0.08	nd	2.84	15.7	6.34
February 2	0.40	0.06	0.29	0.09	0.08	0.01	0.26	0.22	nd	5.36	0.10	2.39
February 11	0.50	0.18	0.43	0.13	0.30	0.03	0.47	0.38	nd	8.20	0.06	nd
February 20	1.01	0.25	0.54	0.19	0.32	0.02	0.52	0.43	nd	19.45	0.29	nd
March 10	0.23	0.02	0.09	0.03	0.03	nd	0.06	0.05	0.17	1.77	nd	nd
March 28	1.01	0.11	0.25	0.08	0.06	nd	0.15	0.15	16.0	17.0	0.31	nd
April 15	0.63	0.06	0.27	0.05	0.03	0.01	0.06	0.08	10.4	9.74	0.35	nd
May 3	0.42	0.04	0.31	0.08	0.05	nd	0.01	0.09	3.33	4.83	0.06	nd
May 21	0.81	0.09	0.10	0.04	0.05	nd	0.06	0.07	18.2	19.1	1.80	nd
Mean Blank	0.086	0.011	0.006	0.002	0.003	0.002	0.004	0.004	0.20	0.86	0.03	1.2
Detec'n Limit (ng/m^3)	0.00018	0.0024	0.0012	0.00079	0.0031	0.0028	0.0066	0.0085	0.40	0.43	0.031	0.43

Notes:
* Blanks have been subtracted
nd - not detected

TABLE F-207

OWMC Preferred Site

Monthly Wet Deposition Analysis for Trace Metal Concentrations* µg/l
(June 1986 to May 1987)

Date	Element								
	As	Be	Cd	Cr	Cu	Fe	Ni	Pb	Zn
1986									
June	nd	nd	1.2	nd	3.0	27.8	nd	nd	17.5
July	nd	nd	nd	18.5	1.3	226.8	nd	nd	19.5
August	nd	nd	nd	18.5	nd	109.8	nd	nd	16.5
September	nd	nd	nd	nd	4.6	46.8	nd	nd	18.5
October	nd	nd	nd	nd	nd	6.8	nd	nd	7.5
November	nd	nd	nd	nd	nd	28.3	nd	nd	11.5
December	nd	nd	nd	nd	3.0	20.6	nd	nd	21.5
1987									
January	nd	nd	nd	nd	1.3	86.2	nd	7.5	18.0
February	nd	nd	nd	3.7	14.6	128.8	nd	12.5	208.5
March	nd	nd	nd	.9	7.2	33.7	2.5	nd	43.5
April	nd	nd	nd	nd	nd	33.8	nd	nd	nd
May	nd	nd	nd	nd	2.1	269.7	5.5	nd	83.8
Mean Blank	.5	.025	.5	.5	1.1	7.3	2.5	2.5	2.5
Det'n Limit	<1.0	<.05	<1.0	<1.0	<.8	<1.0	<5.0	<5.0	<5.0

Notes:
* Blanks have been subtracted
nd - not detected

TABLE F-208

OWMC Preferred Site
Trace Metal Analysis of Particulate Concentrations*
ng/m^3
(June 1986 to May 1987)

Element	1986 June 13		July 1		July 19		August 6	
	TSP	FP	TSP	FP	TSP	FP	TSP	FP
Al	38.6	52.3	93.3	69.5	178.6	61.2	59.8	57.6
As	0.2	0.4	0.0	0.0	0.0	0.0	0.4	0.0
B	0.4	5.0	6.2	5.0	0.4	0.4	1.9	19.5
Be	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Bi	1.2	1.4	1.1	3.7	3.7	3.7	4.1	5.6
Ca	118.4	130.8	510.6	256.8	670.7	204.8	454.9	274.8
Cd	0.0	0.0	0.2	0.4	0.9	0.0	1.3	0.0
Co	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Cr	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.6
Cu	-	-	25.6	7.3	17.6	2.6	17.1	14.2
Fe	47.2	64.1	163.6	110.5	238.8	88.2	186.4	163.5
K	9.2	9.2	64.6	12.7	102.0	27.2	30.3	65.8
Mg	44.8	38.6	227.3	103.6	163.3	42.1	191.8	107.8
Mn	0.2	2.4	6.3	4.6	8.5	3.1	6.8	8.6
Mo	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Na	37.0	37.0	37.0	19.0	19.0	19.0	19.0	186.5
Ni	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.5
P	9.2	9.2	9.2	9.2	9.2	9.2	9.2	107.5
Pb	0.9	12.0	13.4	33.2	2.9	5.9	10.3	30.2
Sb	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.6
Se	0.6	0.7	0.1	0.1	0.0	0.0	0.5	2.1
Si	56.7	82.3	82.2	82.3	183.5	99.5	0.9	40.4
Sn	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Te	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.5
V	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Zn	7.7	14.0	9.1	9.3	13.4	6.5	10.9	27.0

TABLE F-208 (Contd.)

OWMC Preferred Site
Trace Metal Analysis of Particulate Concentrations*
(ng/m^3)
(June 1986 to May 1987)

Element	August 24		September 11		September 29		October 17	
	TSP	FP	TSP	FP	TSP	FP	TSP	FP
Al	11.3	35.5	43.1	52.2	60.4	45.3	32.7	11.2
As	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.3
B	0.4	0.5	0.4	4.1	3.4	0.4	0.4	0.4
Be	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bi	3.7	26.2	3.7	3.7	1.2	1.3	1.2	1.3
Ca	141.1	53.2	153.9	111.8	119.3	73.9	125.1	80.2
Cd	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Co	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Cr	0.2	0.2	1.3	1.2	0.2	0.2	0.2	0.2
Cu	0.7	4.7	2.5	2.3	12.1	1.8	8.6	0.2
Fe	49.4	25.8	90.2	79.9	90.2	48.3	113.3	86.2
K	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2
Mg	43.4	19.9	40.4	32.3	36.4	22.8	34.1	18.4
Mn	3.3	1.5	4.4	3.1	3.2	2.8	8.0	7.5
Mo	0.9	0.9	0.9	0.9	0.9	0.9	0 9	0.9
Na	71.7	19.0	314.3	117.1	37.0	79.2	37.0	37.0
Ni	0.2	0.2	0.6	0.2	0.2	0.2	1.0	1.8
P	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2
Pb	0.9	0.9	5.2	4.7	7.0	9.5	15.6	23.4
Sb	0.0	0.0	0.0	0.0	0.5	0.6	0.5	0.6
Se	0.0	0.0	0.0	0.0	2.1	2.4	0.3	0.3
Si	0.9	34.8	0.9	25.2	83.0	65.6	42.6	0.9
Sn	2.3	0.4	0.4	1.3	0.4	0.4	0.4	0.4
Te	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
V	0.4	0.4	0.5	0.4	0.4	0.4	0.4	2.0
Zn	5.7	5.6	13.9	12.7	21.9	14.5	29.4	32.8

TABLE F-208 (Contd.)

OWMC Preferred Site
Trace Metal Analysis of Particulate Concentrations*
(ng/m^3)
(June 1986 to May 1987)

Element	November 4 TSP	November 4 FP	1987 January 6 TSP	January 6 FP	January 15 TSP	January 15 FP	January 24 TSP	January 24 FP
Al	73.5	27.5	34.5	13.6	7.7	4.3	91.9	12.0
As	0.3	0.3	0.6	0.4	0.2	0.2	0.1	0.1
B	1.9	2.0	10.9	7.6	7.6	4.8	2.0	1.1
Be	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bi	1.2	18.5	1.2	1.4	1.2	1.4	1.2	1.4
Ca	483.8	133.2	82.1	26.3	37.5	18.0	215.9	32.1
Cd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Co	0.2	0.2	0.2	0.2	0.2	0.2	1.9	0.2
Cr	0.2	1.0	0.2	0.5	0.2	0.2	0.5	1.2
Cu	7.1	1.2	17.8	1.6	0.4	0.4	0.2	1.0
Fe	107.2	34.1	65.0	25.9	31.6	13.2	92.9	22.1
K	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2
Mg	107.0	24.6	19.0	6.0	12.9	6.5	109.4	16.7
Mn	4.7	1.3	4.2	2.4	1.0	0.2	2.4	0.2
Mo	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Na	204.8	95.5	37.0	37.0	37.0	37.0	70.1	37.0
Ni	0.2	0.2	2.1	0.2	0.2	0.2	0.2	0.2
P	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2
Pb	13.1	9.9	12.9	8.6	0.9	0.9	0.9	0.9
Sb	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Se	0.4	0.5	1.4	1.7	1.3	1.6	0.2	0.2
Si	78.5	63.8	63.6	9.8	35.1	11.5	119.4	22.4
Sn	0.4	0.4	6.7	11.1	0.4	0.4	5.0	0.4
Te	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.0
V	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Zn	11.5	4.9	9.0	3.3	0.4	0.4	1.7	0.4

TABLE F-208 (Contd.)

OWMC Preferred Site
Trace Metal Analysis of Particulate Concentrations*
(ng/m^3)
(June 1986 to May 1987)

Element	February 2		February 11		February 20		March 10	
	TSP	FP	TSP	FP	TSP	FP	TSP	FP
Al	28.3	41.4	35.1	8.8	38.6	0.2	138.0	28.0
As	0.1	0.4	1.6	2.6	1.9	0.0	0.5	0.2
B	6.5	8.7	1.7	6.8	8.0	2.1	2.7	3.2
Be	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bi	1.2	1.4	1.4	1.4	1.2	1.3	1.1	1.2
Ca	54.2	49.3	497.9	151.6	631.0	0.9	759.2	115.5
Cd	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Co	0.2	0.2	0.2	0.2	1.3	0.2	0.2	0.2
Cr	0.2	0.2	0.2	0.6	1.2	0.2	1.4	0.2
Cu	0.8	1.3	20.5	4.1	25.1	0.2	5.7	0.2
Fe	48.3	68.1	119.6	55.3	139.9	0.3	185.8	34.3
K	9.2	9.2	71.2	9.2	9.2	9.2	9.2	9.2
Mg	11.2	11.6	164.1	35.2	210.6	3.1	232.4	36.4
Mn	1.7	2.5	5.6	3.0	8.1	0.2	9.3	1.6
Mo	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Na	37.0	37.0	356.0	105.8	84.9	37.0	195.7	37.0
Ni	0.2	0.2	2.0	0.7	1.0	0.2	0.7	0.2
P	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2
Pb	0.9	0.9	9.7	10.9	20.8	0.9	4.7	0.9
Sb	0.2	0.0	0.2	0.2	0.2	0.0	0.2	0.2
Se	1.4	2.5	1.5	0.9	0.0	0.0	0.0	0.0
Si	46.9	60.1	0.9	0.9	31.6	0.9	158.4	0.9
Sn	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Te	0.0	0.1	0.3	0.2	0.5	0.0	0.3	0.8
V	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Zn	5.6	12.8	13.5	10.3	23.5	0.4	17.7	2.3

TABLE F-208 (Contd.)

OWMC Preferred Site
Trace Metal Analysis of Particulate Concentrations*
(ng/m^3)
(June 1986 to May 1987)

Element	March 28		April 15		May 3		May 21	
	TSP	FP	TSP	FP	TSP	FP	TSP	FP
Al	16.4	30.5	40.3	42.7	119.4	91.7	0.4	49.3
As	0.6	1.5	0.6	1.0	0.2	0.6	0.0	0.6
B	3.4	11.5	8.3	11.5	2.4	5.3	0.4	0.9
Be	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bi	1.1	1.2	1.1	14.0	1.1	1.2	1.2	1.2
Ca	120.7	98.6	189.7	93.0	508.4	304.5	0.9	114.6
Cd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Co	0.2	0.2	0.2	1.2	0.2	0.2	0.2	0.2
Cr	1.2	1.8	0.2	0.2	0.2	0.2	0.2	0.2
Cu	4.1	3.8	6.9	7.8	2.7	1.6	1.4	3.2
Fe	67.2	98.3	99.1	87.1	157.5	120.5	12.9	73.6
K	9.2	9.2	9.2	9.2	9.2	9.2	9.2	27.4
Mg	25.0	30.7	67.0	38.5	162.6	81.3	0.2	55.9
Mn	6.3	6.0	6.8	5.5	6.3	5.5	0.2	2.7
Mo	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Na	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0
Ni	0.7	1.8	2.6	2.8	0.2	0.2	0.2	0.2
P	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2
Pb	0.9	16.2	0.9	7.3	4.8	0.9	0.9	0.9
Sb	0.2	0.2	0.2	0.3	0.0	0.1	0.0	0.2
Se	0.5	2.0	5.8	5.0	0.1	0.2	0.0	0.8
Si	0.9	0.9	26.6	28.9	76.5	74.6	10.9	26.2
Sn	0.4	0.4	11.7	0.4	0.4	0.4	0.4	0.4
Te	0.2	0.8	0.0	0.0	0.0	0.0	0.0	0.0
V	0.6	0.4	1.4	2.9	0.4	5.0	0.4	0.4
Zn	9.6	17.8	11.7	19.0	9.6	10.1	0.4	7.0

TABLE F-208 (Contd.)

OWMC Preferred Site
Trace Metal Analysis of Particulate Concentrations*
(ng/m^3)
(June 1986 to May 1987)

Element	Mean Blank	Detection Limit (ng/m^3)	Annual Arith. Mean TSP	Annual Arith. Mean FP	Annual Geo. Mean TSP	Annual Geo. Mean FP
Al	9.3	0.37	57.1	36.8	36.6	25.8
As	0.06	.012	0.4	0.4	0.1	0.1
B	2.1	0.74	3.5	5.0	1.8	2.9
Be	0.12	.061	0.0	0.0	0.0	0.0
Bi	11.0	7.4	1.7	4.6	1.5	2.4
Ca	26.3	1.8	293.8	116.2	165.1	80.0
Cd	0.37	.061	0.2	0.1	0.1	0.0
Co	0.67	0.37	0.3	0.2	0.2	0.2
Cr	1.0	0.37	0.4	0.5	0.3	0.3
Cu	1.2	0.37	9.3	3.4	5.0	1.9
Fe	14.4	0.74	105.3	65.0	85.7	46.9
K	11.5	18.4	20.8	14.0	13.5	11.5
Mg	8.5	0.37	95.2	36.6	50.6	26.7
Mn	0.67	0.37	4.9	3.3	3.1	2.4
Mo	2.7	1.8	0.9	0.9	0.9	0.9
Na	77.0	36.8	87.1	54.3	56.8	44.1
Ni	0.67	0.37	0.7	0.6	0.4	0.3
P	27.1	18.4	9.2	14.1	9.2	10.4
Pb	1.2	1.8	6.4	9.0	3.5	4.3
Sb	0.06	.012	0.1	0.2	0.1	0.1
Se	0.06	.012	0.8	1.0	0.1	0.3
Si	22.1	1.8	55.0	36.6	20.3	16.5
Sn	2.5	0.74	1.6	1.0	0.6	0.5
Te	0.25	.012	0.1	0.1	0.0	0.0
V	0.57	0.74	0.4	0.8	0.4	0.5
Zn	1.8	0.74	11.3	10.6	7.6	7.0

TABLE F-208 (Contd.)

OWMC Preferred Site
Trace Metal Analysis of Particulate Concentrations*
(ng/m^3)
(June 1986 to May 1987)

Element	Spring Arith. Mean TSP	Spring Arith. Mean FP	Spring Geo. Mean TSP	Spring Geo. Mean FP	Summer Arith. Mean TSP	Summer Arith. Mean FP	Summer Geo. Mean TSP	Summer Geo. Mean FP
Al	62.9	48.4	21.6	44.0	76.3	55.2	53.4	53.9
As	0.4	0.8	0.2	0.7	0.1	0.1	0.0	0.0
B	3.5	6.5	2.3	4.6	1.8	6.1	0.9	2.4
Be	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bi	1.1	3.8	1.1	2.0	2.7	8.1	2.4	4.9
Ca	315.8	145.2	95.9	129.9	379.1	184.1	304.1	158.6
Cd	0.0	0.0	0.0	0.0	0.5	0.1	0.2	0.1
Co	0.2	0.4	0.2	0.3	0.2	0.2	0.2	0.2
Cr	0.6	0.5	0.4	0.3	0.2	0.5	0.2	0.3
Cu	4.2	3.3	3.6	2.0	14.2	7.4	8.8	6.3
Fe	104.5	82.8	75.9	76.4	137.0	90.4	111.1	76.6
K	9.2	12.8	9.2	11.4	43.1	24.8	27.9	18.1
Mg	97.5	48.6	26.1	45.5	134.1	62.4	106.7	51.4
Mn	5.8	4.3	3.4	3.8	5.0	4.0	3.0	3.4
Mo	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Na	68.7	37.0	51.6	37.0	36.7	56.1	32.3	34.3
Ni	0.9	1.0	0.5	0.5	0.2	0.5	0.2	0.3
P	9.2	9.2	9.2	9.2	9.2	28.9	9.2	15.0
Pb	2.5	5.2	1.8	2.5	5.7	16.4	3.2	9.2
Sb	0.1	0.2	0.1	0.2	0.1	0.1	0.0	0.0
Se	1.3	1.6	0.1	0.4	0.2	0.6	0.1	0.1
Si	54.7	26.3	20.0	8.6	64.9	67.8	14.9	62.4
Sn	2.6	0.4	0.7	0.4	0.8	0.4	0.5	0.4
Te	0.1	0.3	0.6	0.0	0.1	0.1	0.0	0.0
V	0.6	1.8	0.5	0.9	0.4	0.4	0.4	0.4
Zn	9.8	11.2	5.9	8.9	9.4	12.5	9.0	10.5

TABLE F-208 (Contd.)

OWMC Preferred Site
Trace Metal Analysis of Particulate Concentrations*
(ng/m^3)
(June 1986 to May 1987)

Element	Fall Arith. Mean TSP	Fall Arith. Mean FP	Fall Geo. Mean TSP	Fall Geo. Mean FP	Winter Arith. Mean TSP	Winter Arith. Mean FP	Winter Geo. Mean TSP	Winter Geo. Mean FP
Al	52.4	34.1	50.0	29.2	39.4	13.4	31.3	6.1
As	0.2	0.2	0.1	0.1	0.8	0.6	0.4	0.3
B	1.5	1.7	1.0	1.0	6.1	5.2	4.9	4.2
Be	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bi	1.8	6.2	1.6	3.3	1.2	1.3	1.2	1.4
Ca	220.5	99.8	182.6	96.9	253.1	46.4	149.8	21.7
Cd	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Co	0.2	0.2	0.2	0.2	0.7	0.2	0.4	0.2
Cr	0.5	0.6	0.3	0.5	0.4	0.5	0.3	0.4
Cu	7.6	1.4	6.6	1.0	10.8	1.4	2.9	0.9
Fe	100.2	62.1	99.7	58.0	82.9	30.8	73.2	14.4
K	9.2	9.2	9.2	9.2	19.5	9.2	12.9	9.2
Mg	54.4	24.5	48.1	24.0	87.9	13.2	46.7	9.7
Mn	5.1	3.7	4.8	3.0	3.8	1.4	3.0	0.7
Mo	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Na	148.3	82.2	96.9	75.7	103.7	48.5	68.9	44.1
Ni	0.5	0.6	0.4	0.3	1.0	0.3	0.6	0.2
P	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2
Pb	10.2	11.9	9.3	10.1	7.7	3.9	3.6	2.0
Sb	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.0
Se	0.7	0.8	0.2	0.2	1.0	1.1	0.4	0.4
Si	51.3	38.9	22.5	17.7	49.6	17.6	26.7	7.1
Sn	0.4	0.6	0.4	0.5	2.2	2.2	0.9	0.7
Te	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0
V	0.4	0.8	0.4	0.6	0.4	0.4	0.4	0.4
Zn	19.2	16.2	17.9	13.2	8.9	4.6	4.6	1.7

Notes:
NA - not available
*Blanks have been subtracted

TABLE F-209

Summary of Trace Metal Means and Maximum Concentrations (ng/m^3) at OWMC Preferred Site Values and Literature Values (1986-1987)

Element	Site Maximum 24-hr	Site Geometric Mean 1-yr	Literature Value Recorded Range 24-hr	Literature Value Recorded Geometric Mean Range 1-yr
Aluminum (Al)	179.	36.6	30.-12216. (2)	NA
Arsenic (As)	2.6	.1	.2-329. (2)	NA
Boron (B)	19.5	1.8	NA	NA
Beryllium (Be)	nd	nd	NA	NA
Bismuth (Bi)	nd	nd	NA	NA
Calcium (Ca)	759.	165.	<8.-18070.(2)	NA
Cadmium (Cd)	.4	.1	1.-43. (1)	.0-1. (1)
Cobalt (Co)	1.9	.2	10. (1)	NA
Chromium (Cr)	11.1*	.3	12.-24. (1)	1.-2. (1)
Copper (Cu)	25.6	5.0	240.-3430. (1)	60.-610. (1)
Iron (Fe)	531.*	85.7	2100.-11800.(1)	200.-1500.(1)
Potassium (K)	102.	13.5	26.-1857. (2)	NA
Magnesium (Mg)	232.	50.6	NA	NA
Manganese (Mn)	9.3	3.1	39.-1040. (1)	6.-77. (1)
Molybdenum (Mo)	nd	nd	NA	NA
Sodium (Na)	356.	56.8	NA	NA
Nickel (Ni)	5.5*	.4	10.-3430. (1)	1.-102. (1)
Phosphorus (P)	108.	9.2	NA	NA
Lead (Pb)	33.2	3.5	100.-1200. (1)	100.-300. (1)
Antimony (Sb)	.6	.1	NA	NA
Selenium (Se)	5.8	.1	.95-20. (2)	
Silicon (Si)	184.	20.3	NA	NA
Tin (Sn)	11.7	.6	.058 (2)	NA
Tellurium (Te)	.8	.0	NA	NA
Vanadium (V)	5.0	.4	12.-73. (1)	1.-3. (1)
Zinc (Zn)	32.8	7.6	200.-300. (1)	.0-1. (1)

Notes:
nd - not detected
NA - not available
(1)- MOE measured values (maximum values in Niagara Peninsula) (see Appendix H
(2) - published data (see Appendix I)
* - Recorded Spring 1986

APPENDIX F-1

F-1 Minisonde Temperature Profiles

FIGURE I MINISONDE TEMPERATURE PROFILES APRIL 1, 1986

CONDITIONS: Mean Temp 16.2 °C, Precip NA, Mean Wind Speed 11.9 km/hr, Prev. Wind Dir. NA, Clear

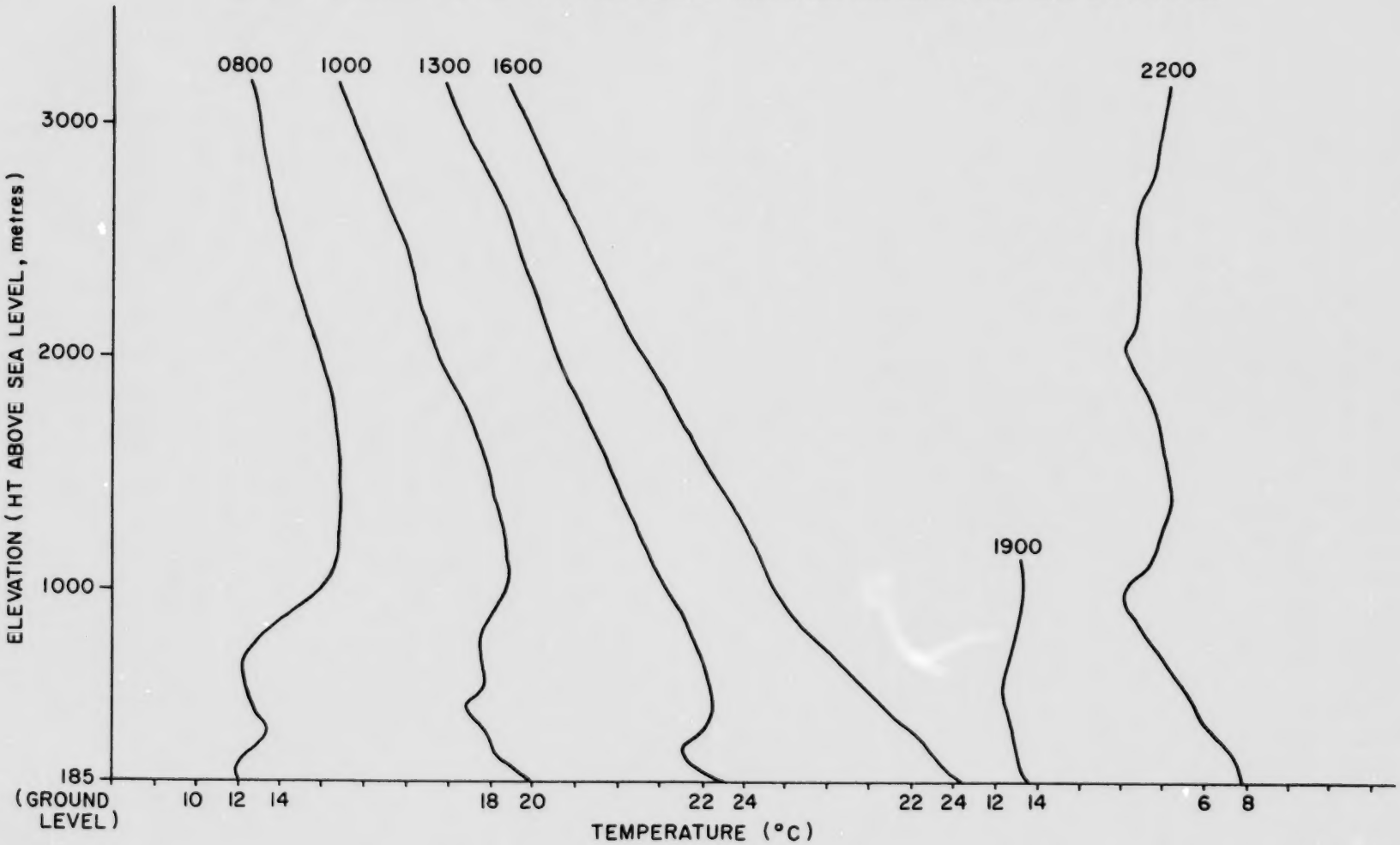


FIGURE 2 MINISONDE TEMPERATURE PROFILES APRIL 2, 1986

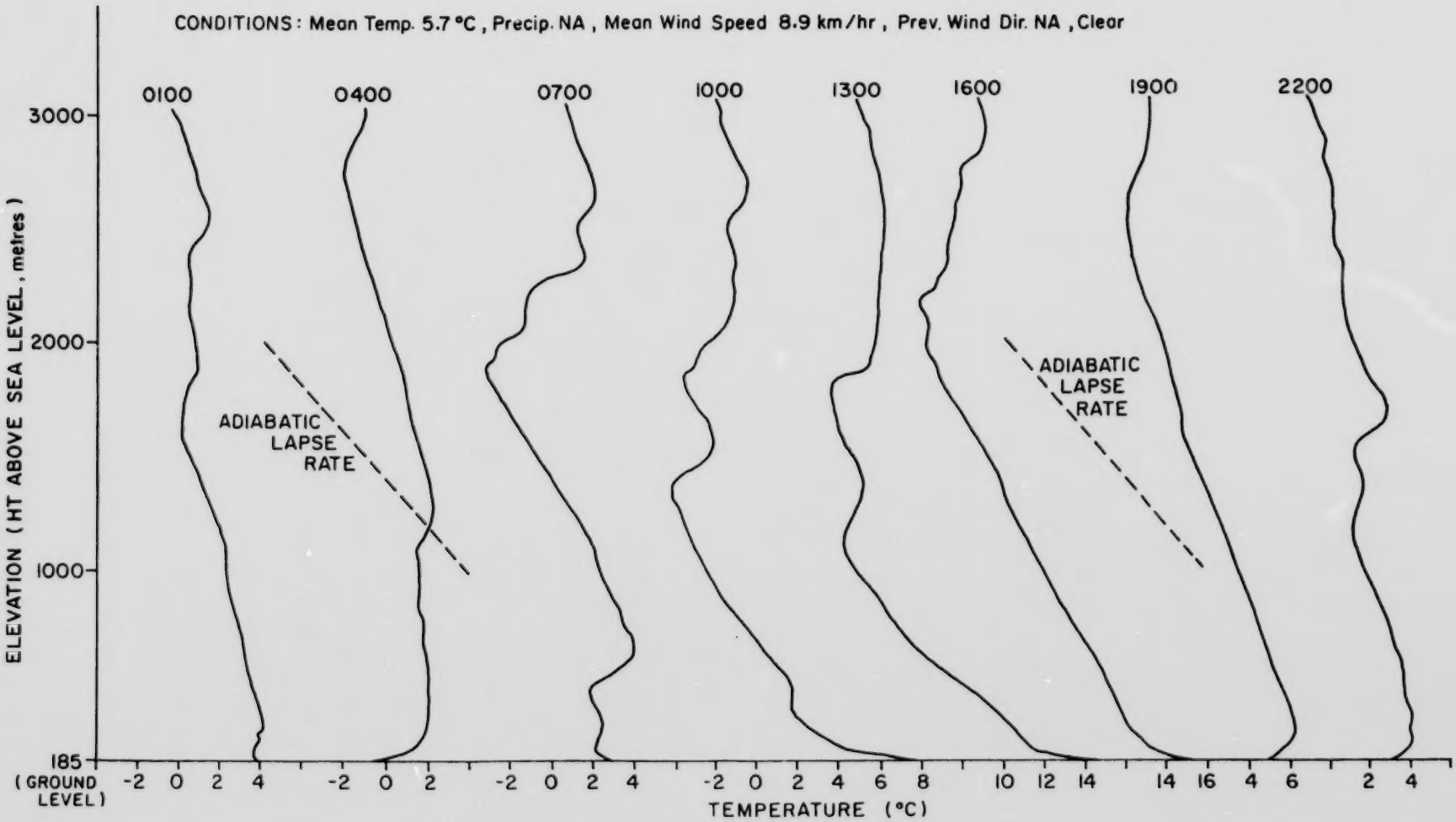


FIGURE 3 MINISONDE TEMPERATURE PROFILES APRIL 3, 1986

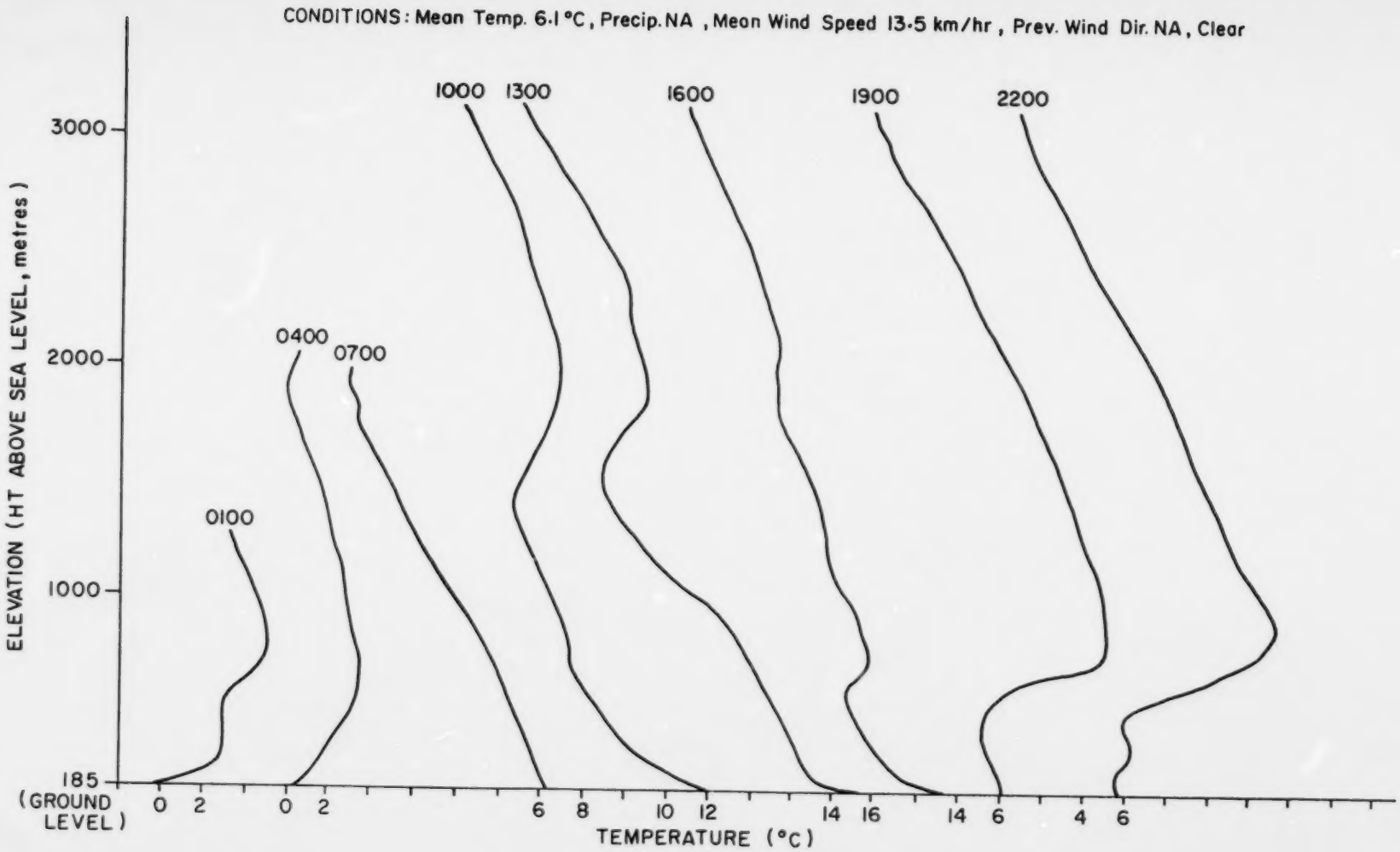


FIGURE 4 MINISONDE TEMPERATURE PROFILES APRIL 4, 1986

CONDITIONS: Mean Temp. 4.9 °C, Precip 1.25 mm, Mean Wind Speed 16.2 km/hr, Prev. Wind Dir. NA, Cloudy

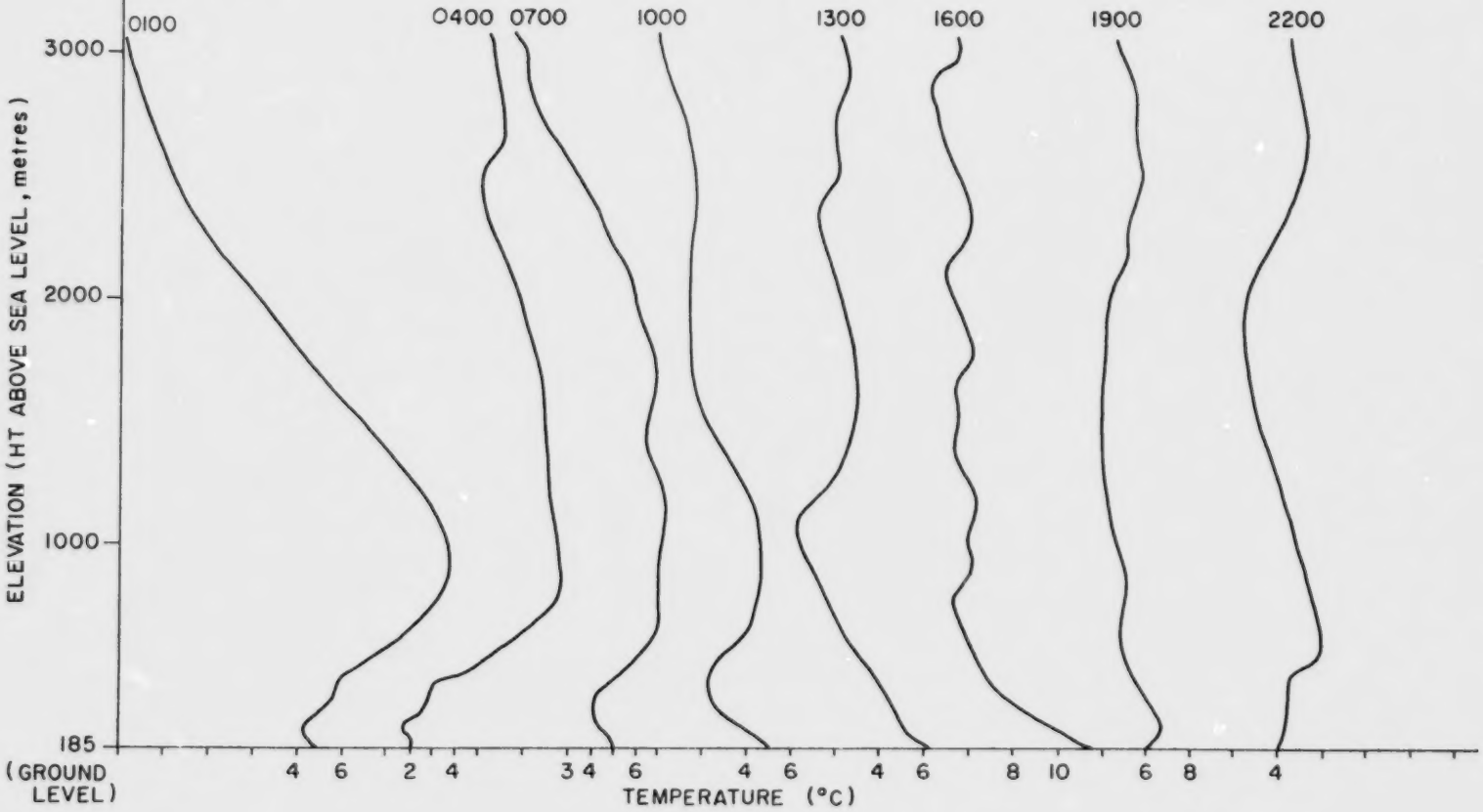


FIGURE 5 MINISONDE TEMPERATURE PROFILES APRIL 5, 1986

CONDITIONS: Mean Temp. 3.5 °C, Precip. 20.75 mm, Mean Wind Speed 12.4 km/hr, Prev. Wind Dir. NA, Raining

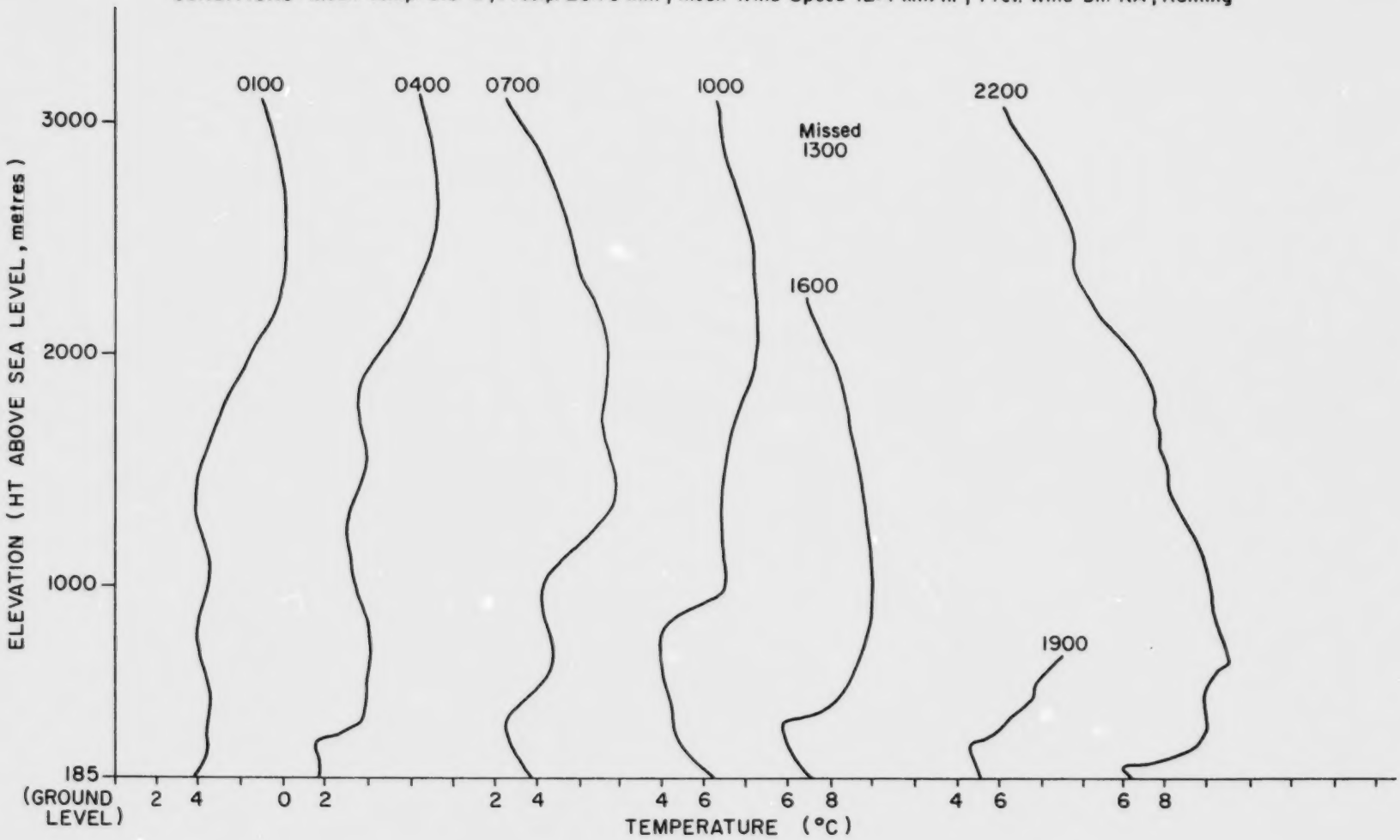


FIGURE 6 MINISONDE TEMPERATURE PROFILES APRIL 6, 1986

CONDITIONS: Mean Temp. 11.9 °C, Precip. .25 mm, Mean Wind Speed NA, Prev. Wind Dir. WNW, Cloudy

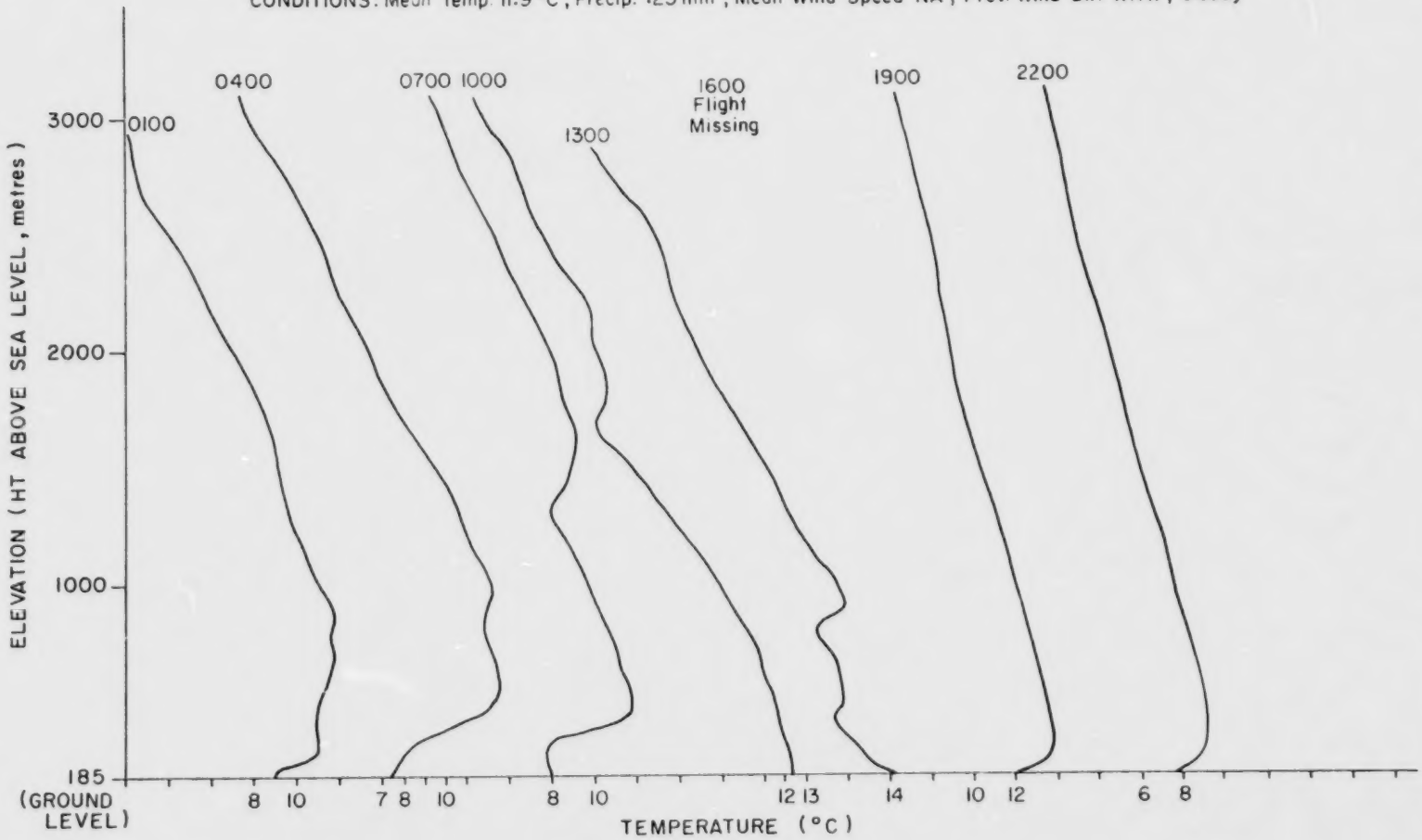


FIGURE 7 MINISONDE TEMPERATURE PROFILES APRIL 7, 1986

CONDITIONS : Mean Temp. 10.9 °C , Precip. 5.0 mm , Mean Wind Speed 19.5 km/hr , Prev. Wind Dir. WNW , Cloudy

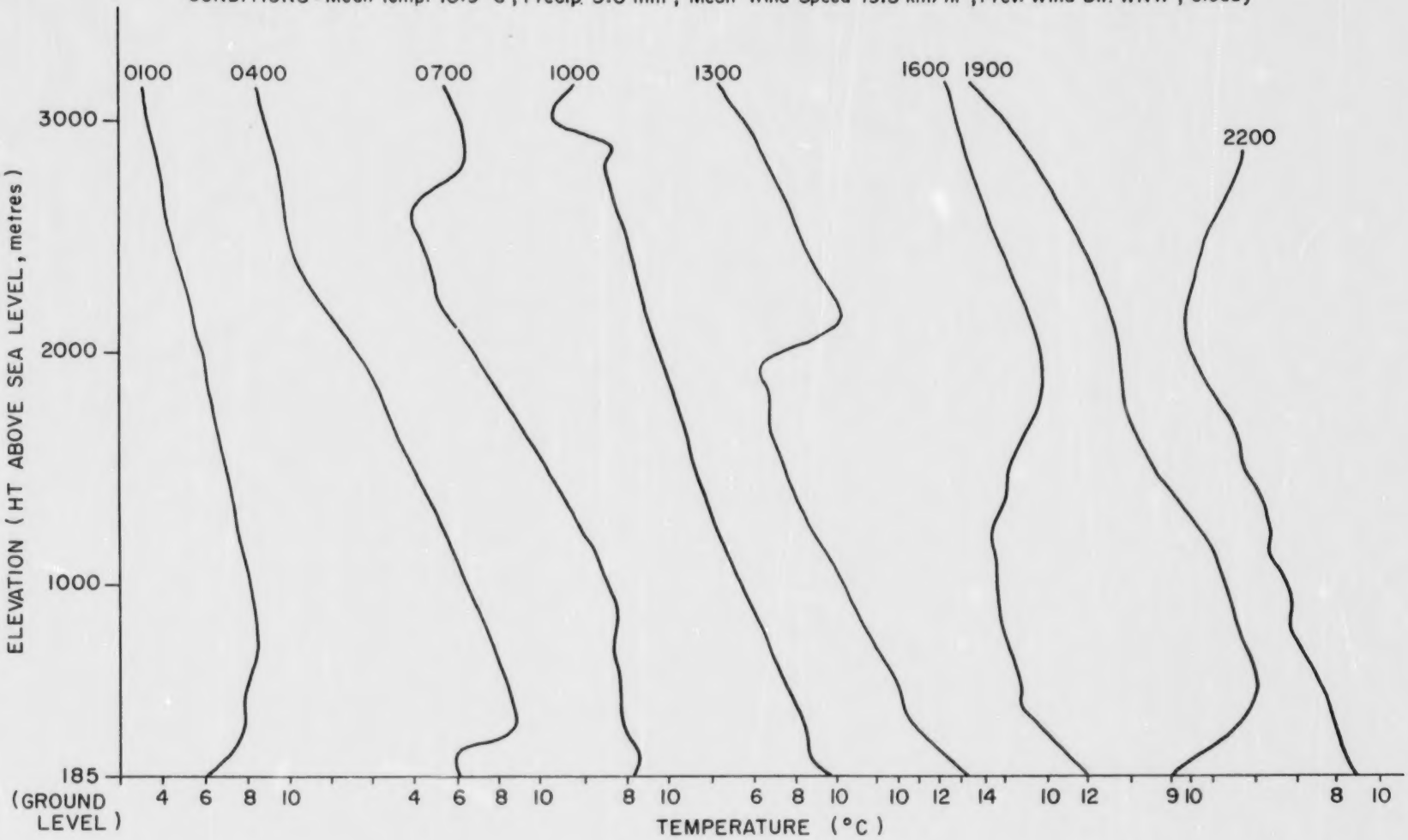


FIGURE 8 MINISONDE TEMPERATURE PROFILES APRIL 8, 1986

CONDITIONS: Mean Temp. 6.9 °C, Precip. 0mm, Mean Wind Speed 15.2 km/hr, Prev. Wind Dir. N, Cloudy

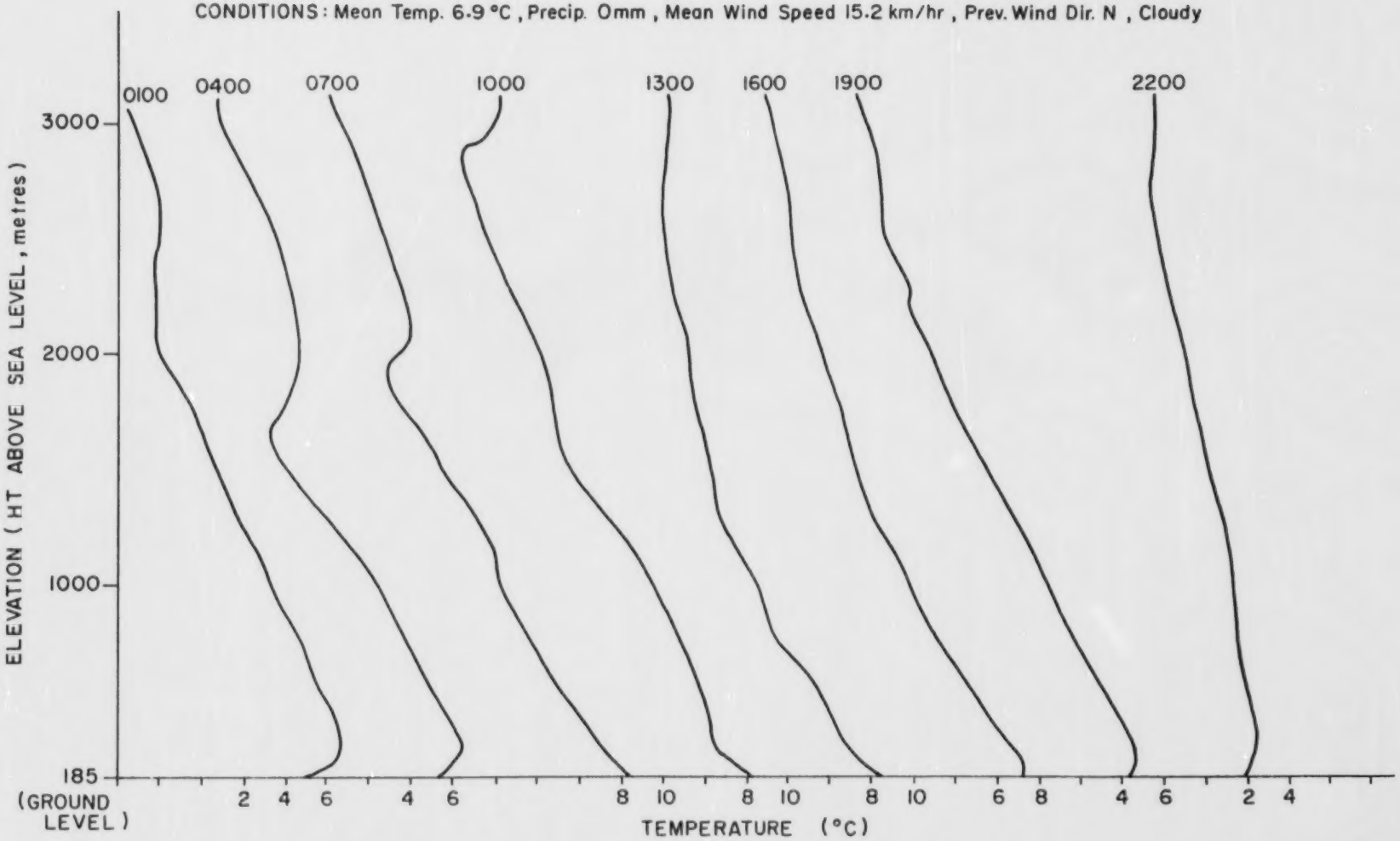


FIGURE 9 MINISONDE TEMPERATURE PROFILES APRIL 9, 1986

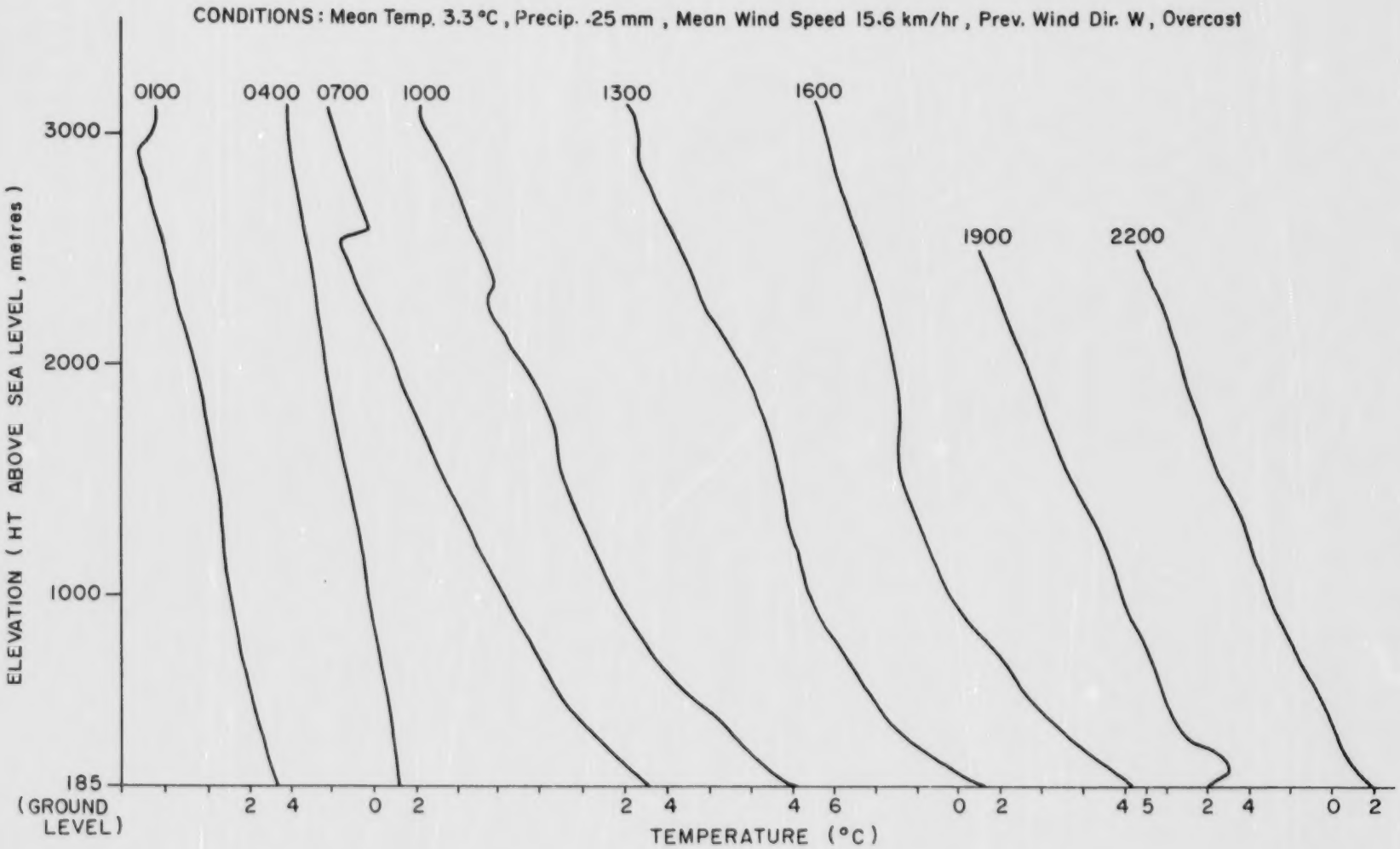


FIGURE 10 MINISONDE TEMPERATURE PROFILES APRIL 10, 1986

CONDITIONS : Mean Temp. 0.9 °C , Precip. .75 mm , Mean Wind Speed 14.4 km/hr , Prev. Wind Dir. WNW , Overcast

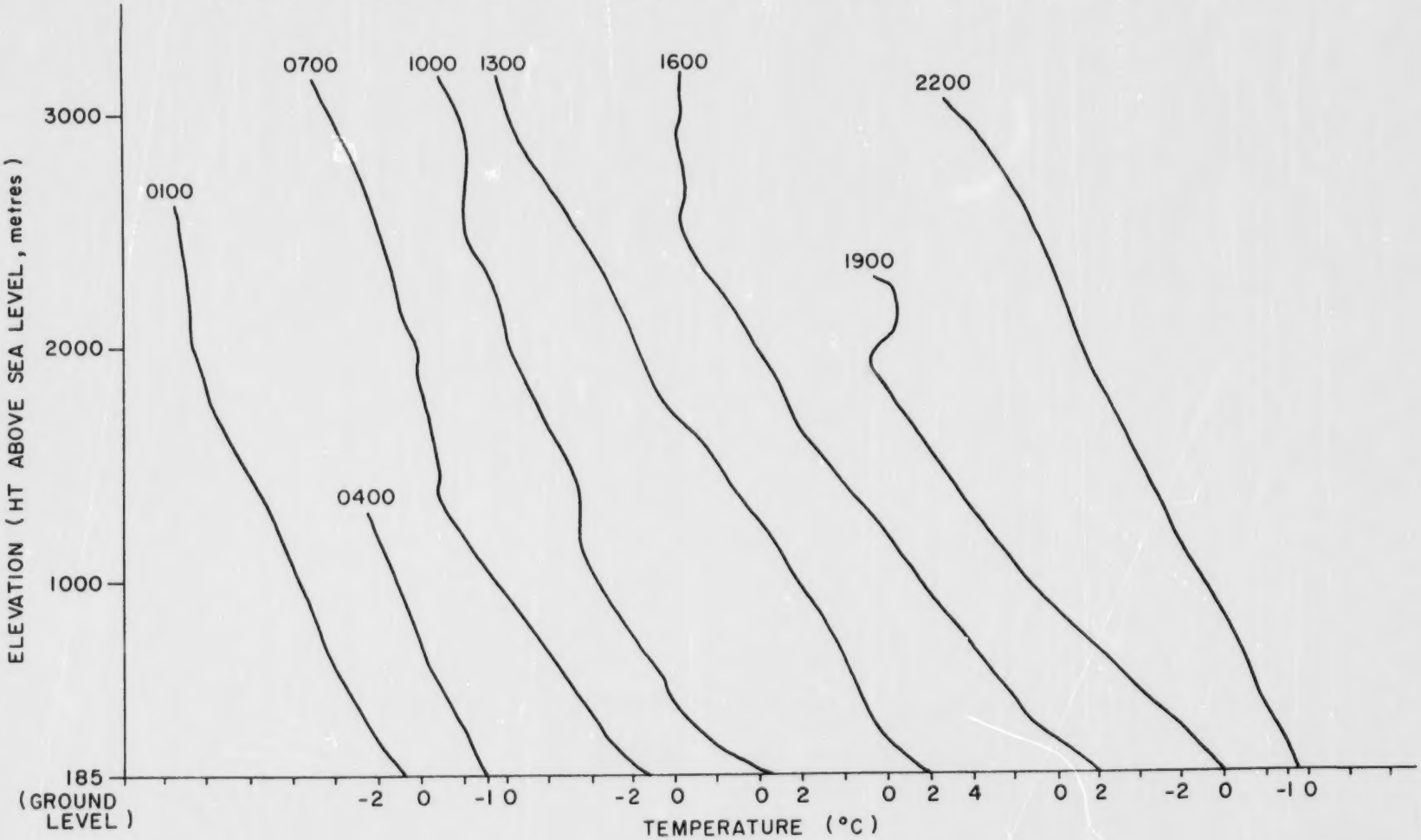


FIGURE 11 MINISONDE TEMPERATURE PROFILES APRIL 11, 1986

CONDITIONS: Mean Temp. 0.7 °C, Precip. .25 mm, Mean Wind Speed 11.7 km/hr, Prev. Wind Dir. W, Overcast

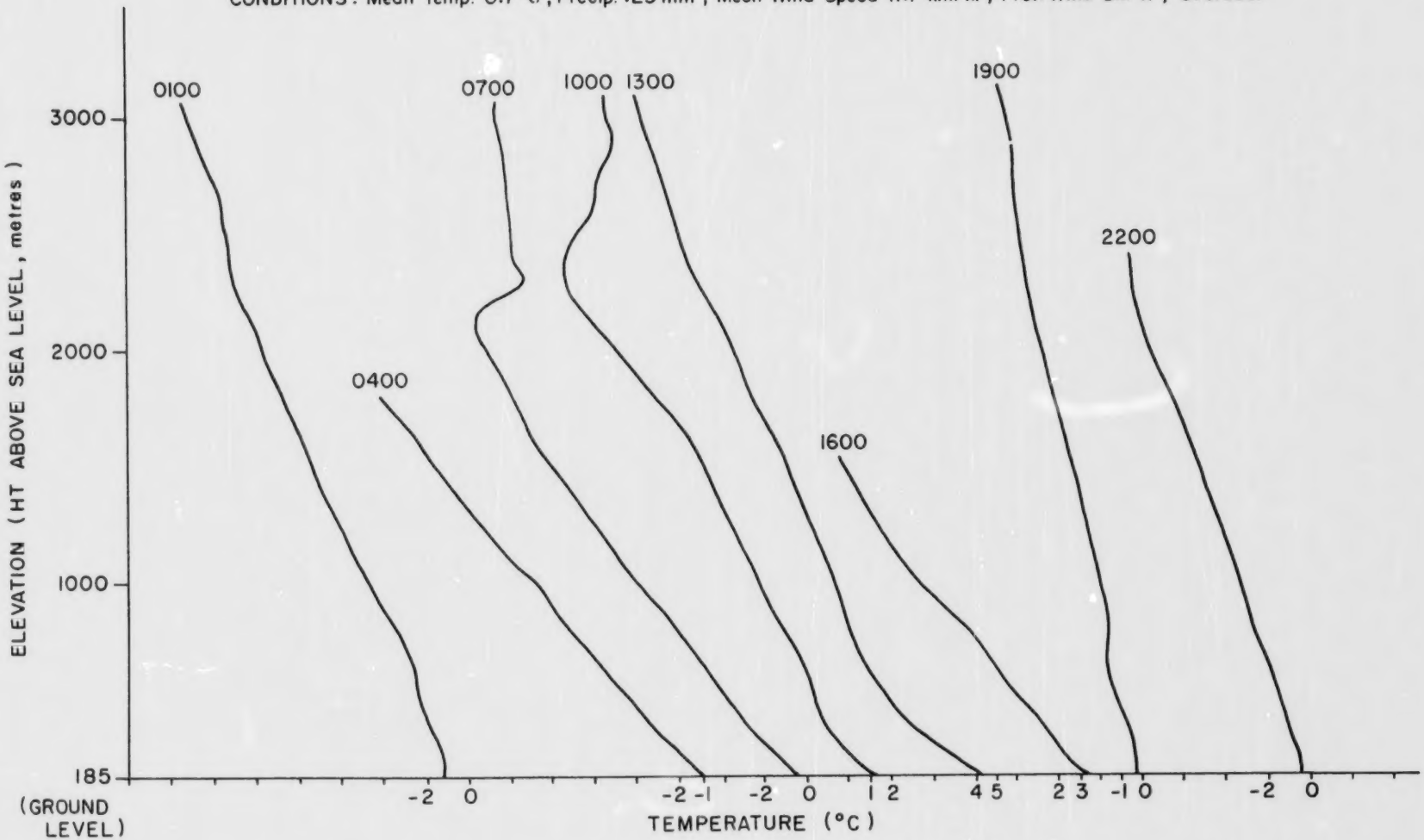


FIGURE 12 MINISONDE TEMPERATURE PROFILES APRIL 12, 1986

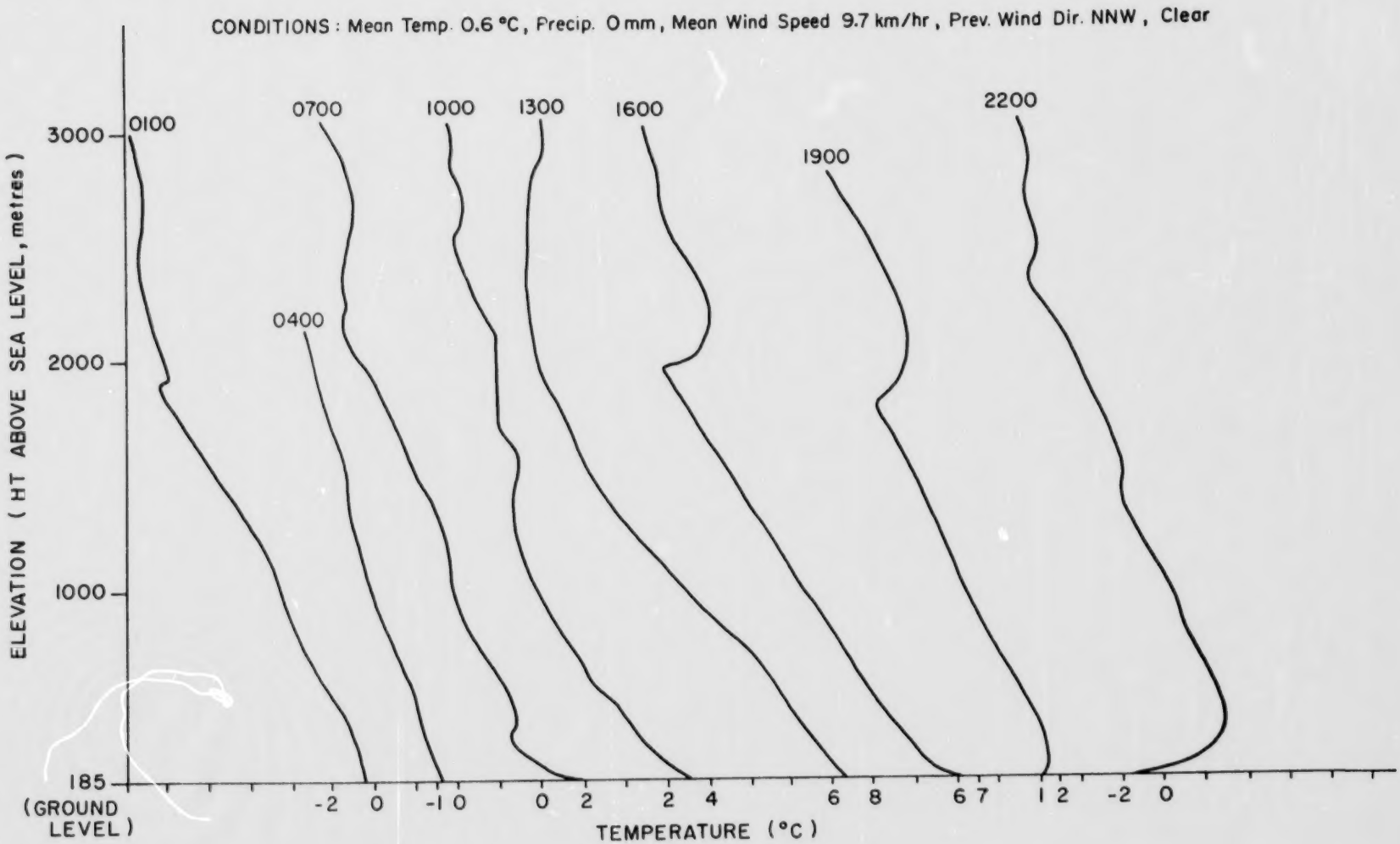


FIGURE 13 MINISONDE TEMPERATURE PROFILES APRIL 13, 1986

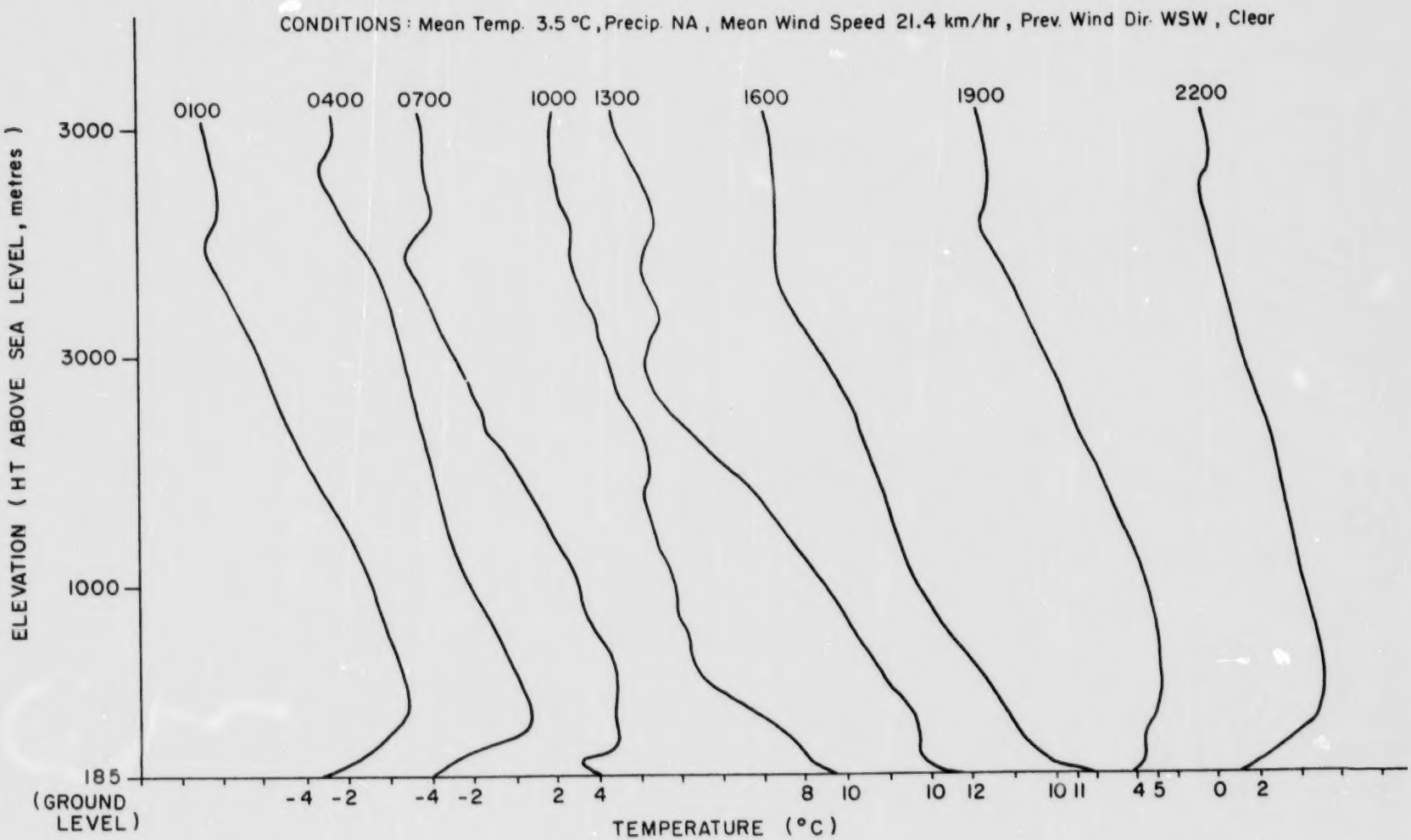


FIGURE 14 MINISONDE TEMPERATURE PROFILES APRIL 14, 1986

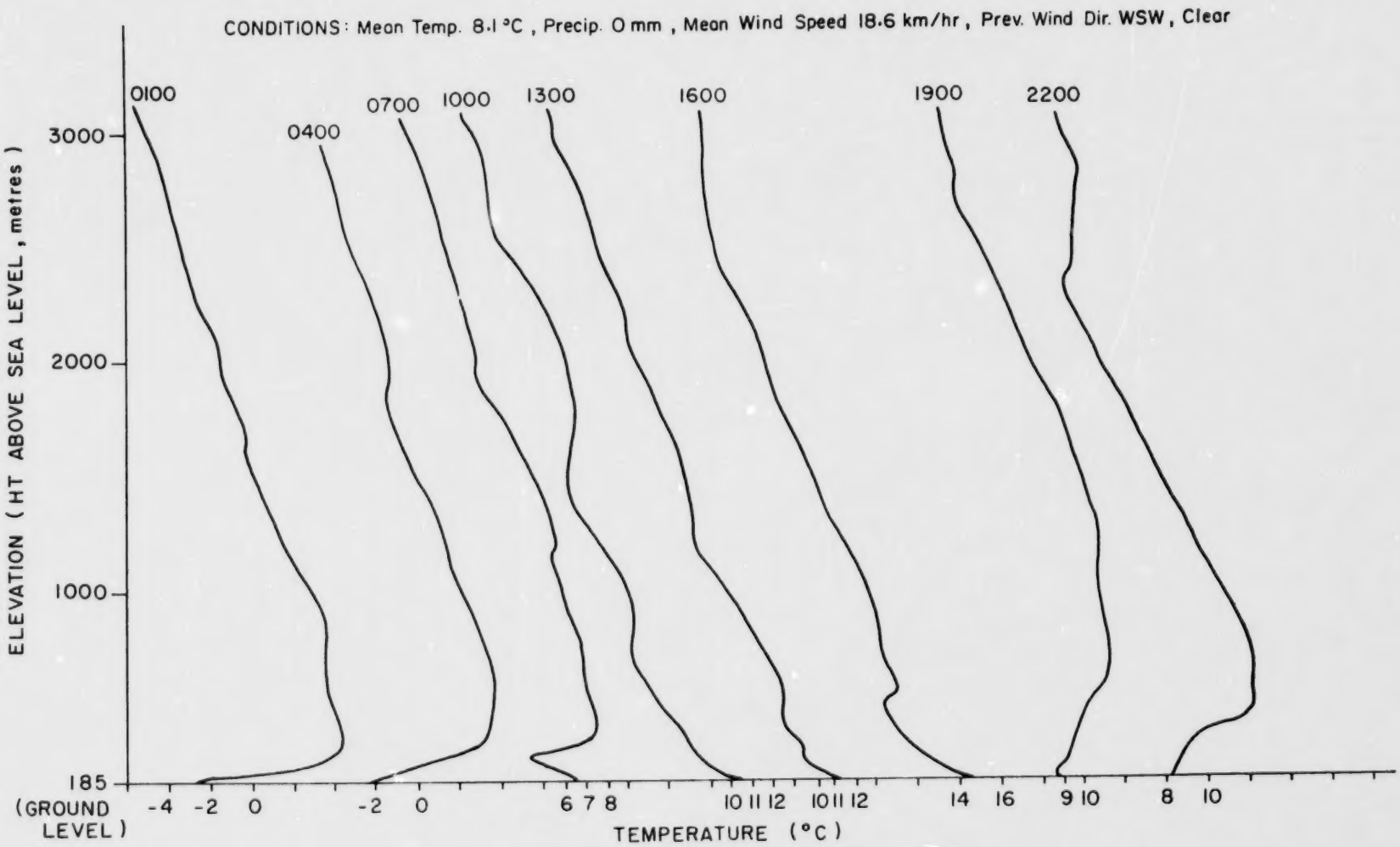


FIGURE 15 MINISONDE TEMPERATURE PROFILES APRIL 15, 1986

CONDITIONS: Mean Temp. 8.1 °C, Precip. 8.5 mm, Mean Wind Speed 11.5 km/hr, Prev. Wind Dir. E, Overcast

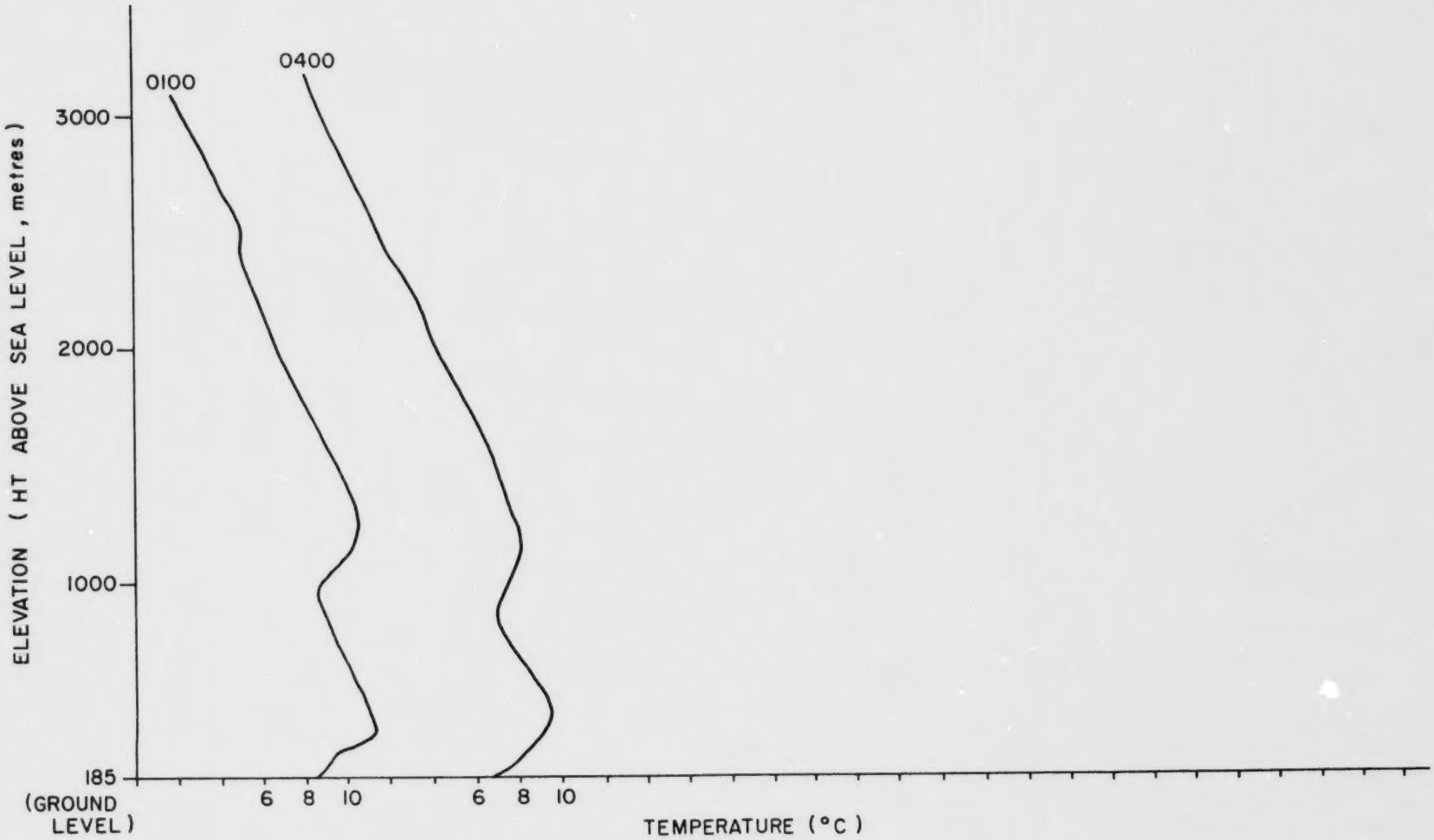


FIGURE 16 MINISONDE TEMPERATURE PROFILES JULY 1, 1986

CONDITIONS: Mean Temp. 17.7 °C, Precip. 0 mm, Mean Wind Spd. 4.3 km/hr, Prev. Wind Dir. N, Cloudy

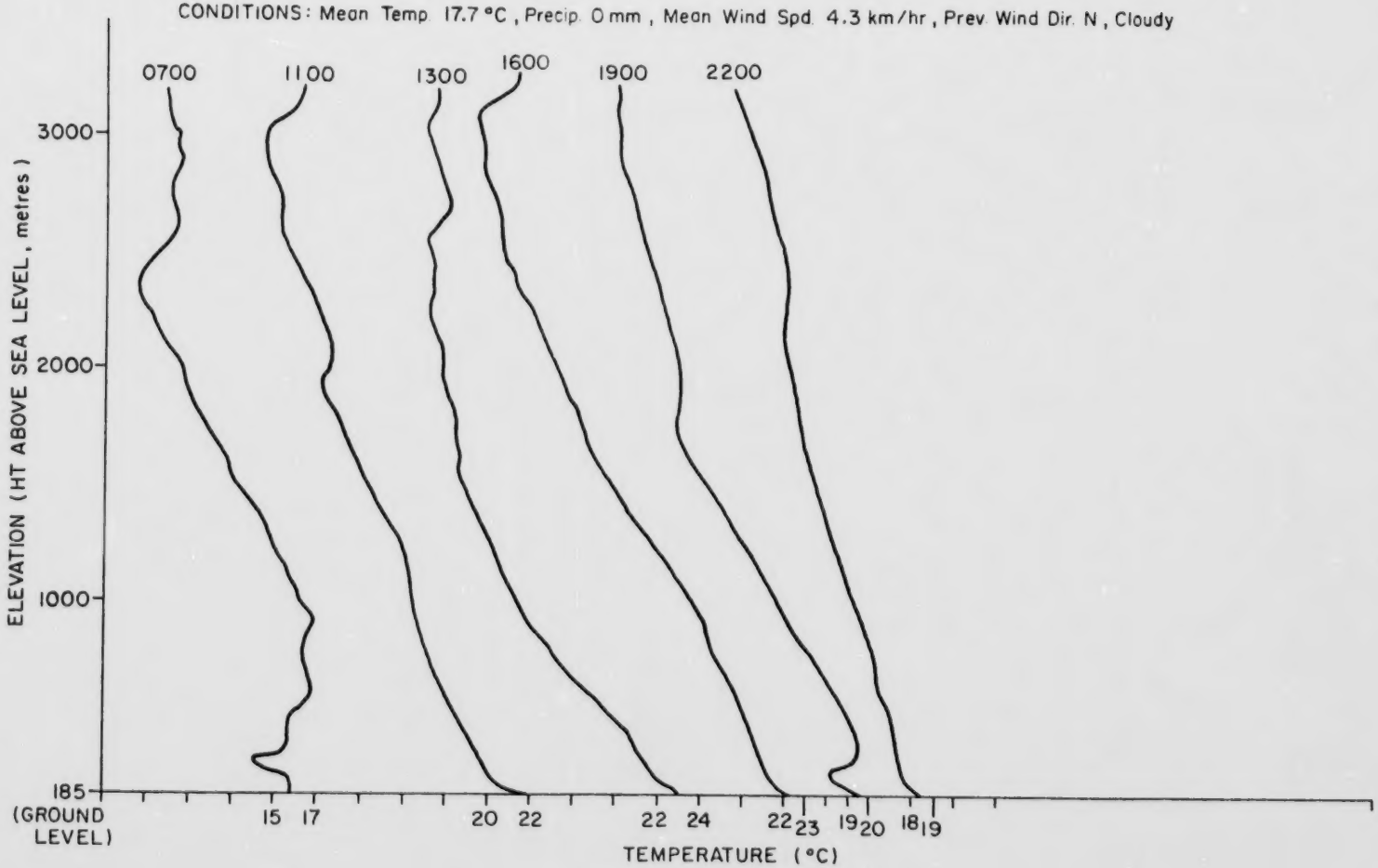


FIGURE 17 MINISONDE TEMPERATURE PROFILES JULY 2, 1986

CONDITIONS: Mean Temp. 18.8 °C, Precip. 1.25 mm, Mean Wind Spd. 7.0 km/hr, Prev. Wind Dir. N, Cloudy

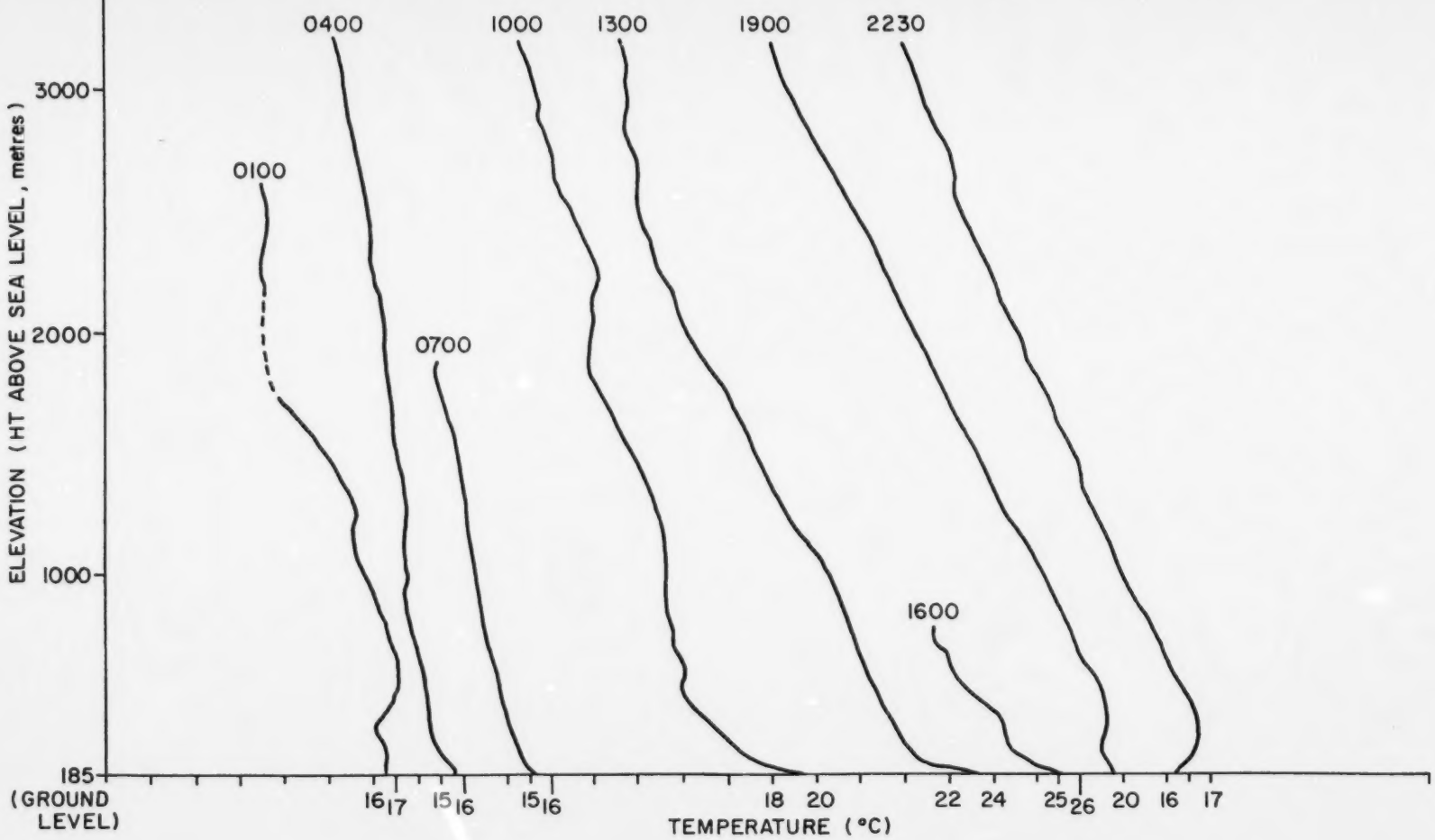


FIGURE 18 MINISONDE TEMPERATURE PROFILES JULY 3, 1986

CONDITIONS: Mean Temp. 16.4 °C, Precip. 0 mm, Mean Wind Spd. 9.5 km/hr, Prev. Wind Dir. WNW, Clear

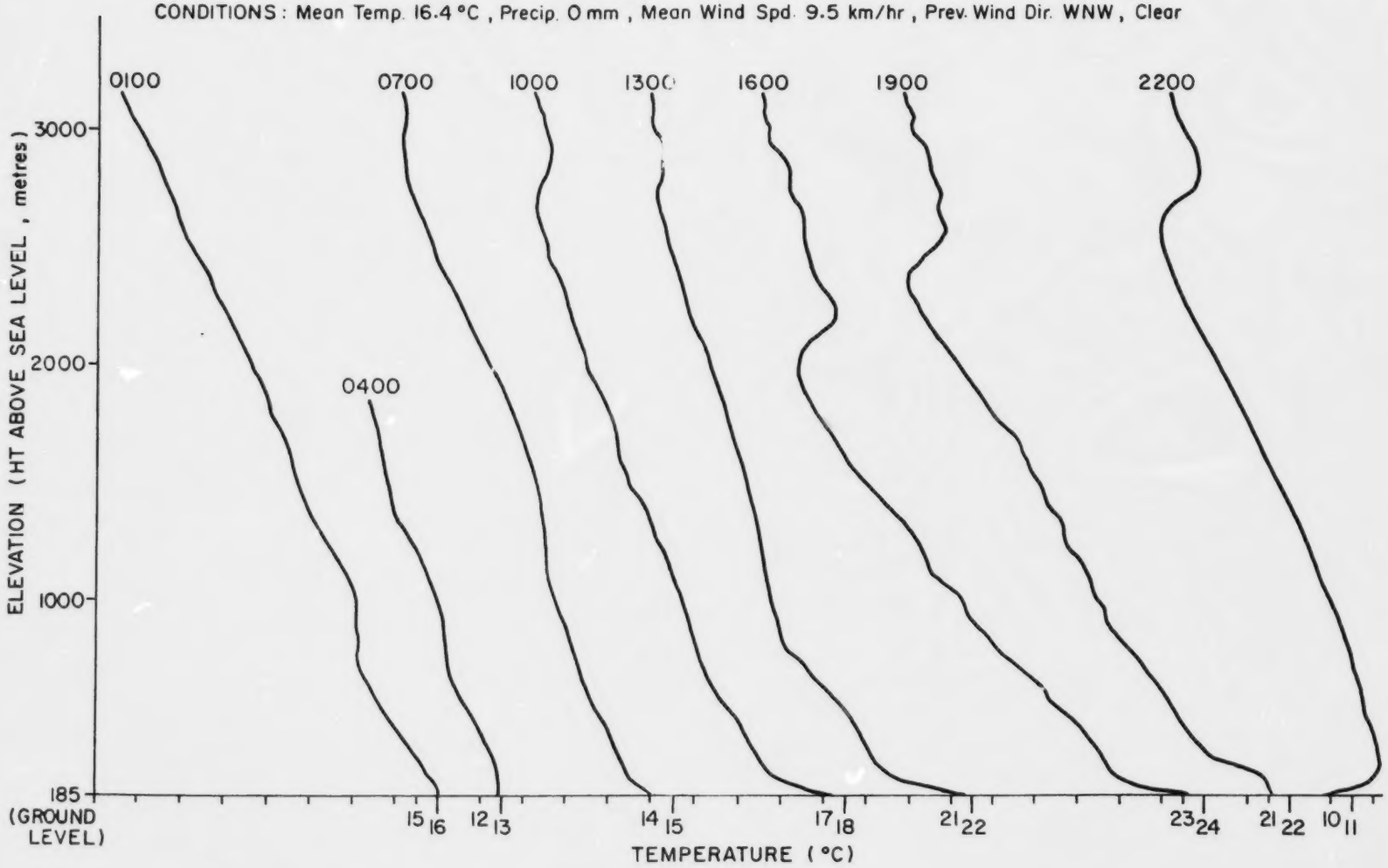


FIGURE 19 MINISONDE TEMPERATURE PROFILES JULY 4, 1986

CONDITIONS: Mean Temp. 18.2 °C, Precip. 0 mm, Mean Wind Spd. 15.3 km/hr, Prev. Wind Dir. N, Partly Sunny

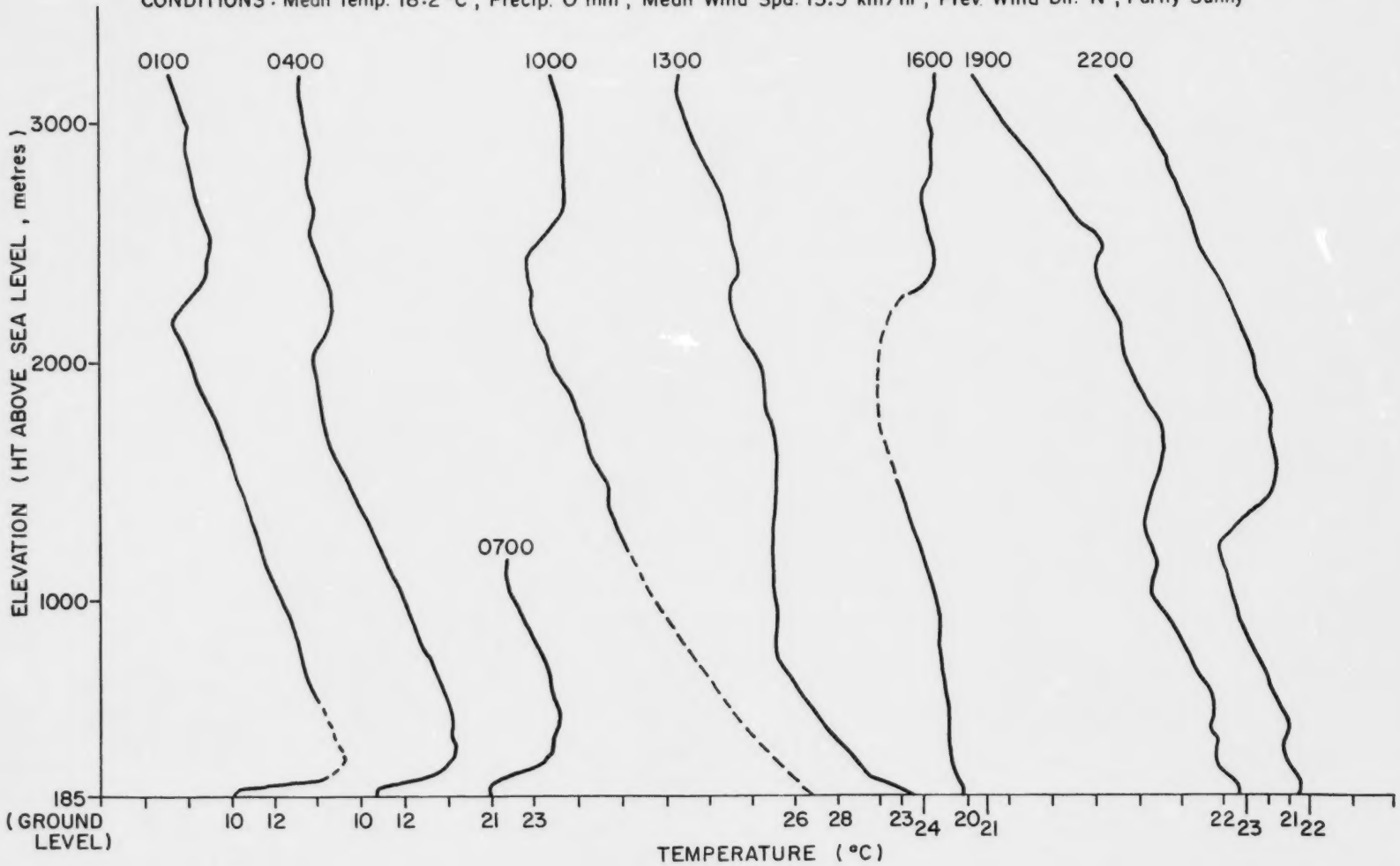


FIGURE 20 MINISONDE TEMPERATURE PROFILES JULY 5,1986

CONDITIONS: Mean Temp. 23.7°C, Precip. 0mm, Mean Wind Spd. 16.3 km/hr, Prev. Wind Dir. SW, Partly Cloudy

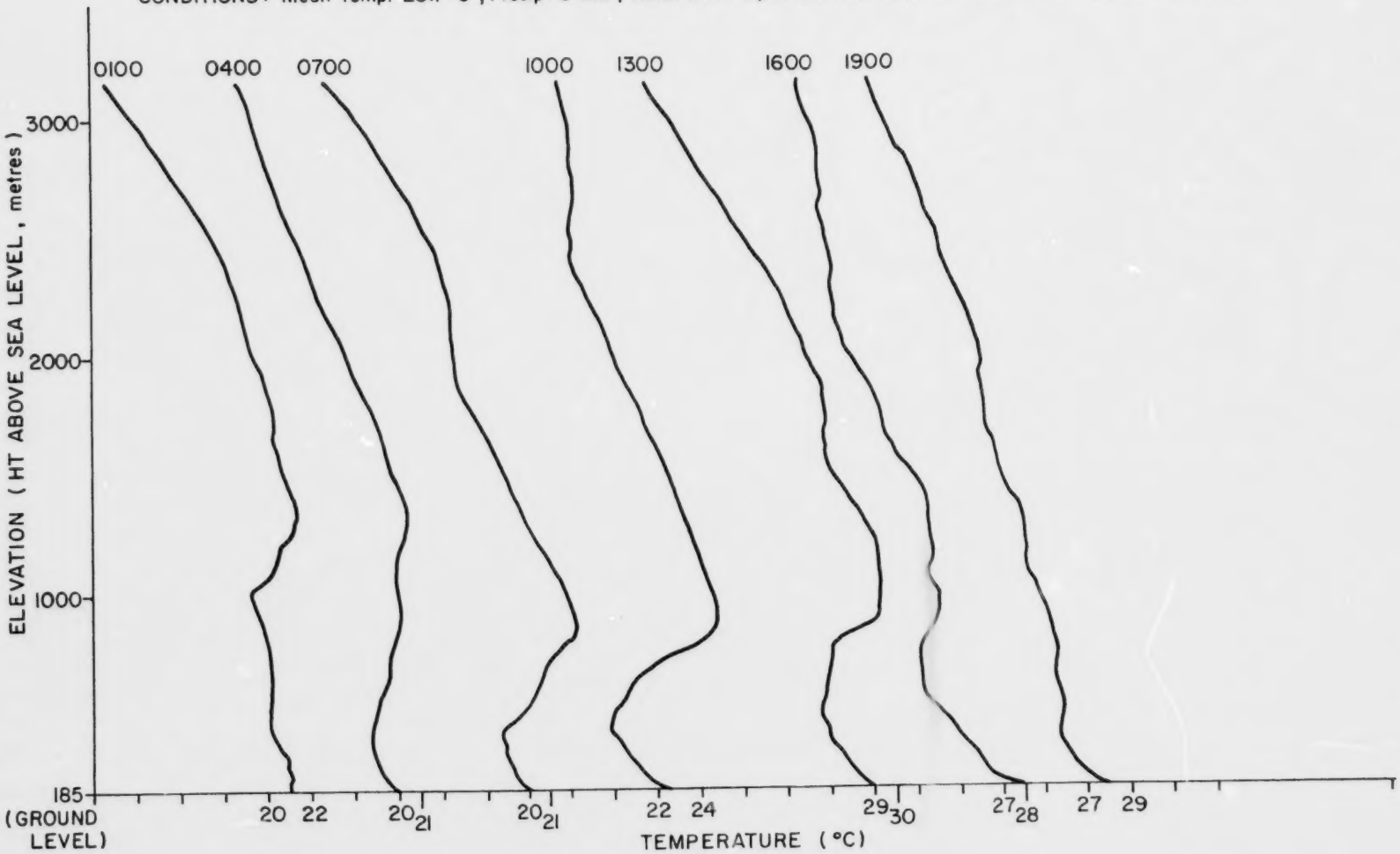


FIGURE 21 MINISONDE TEMPERATURE PROFILES JULY 6, 1986

CONDITIONS : Mean Temp. 25.2 °C , Precip. 0 mm , Mean Wind Spd. 12.4 km/hr , Prev. Wind Dir. SW , Clear

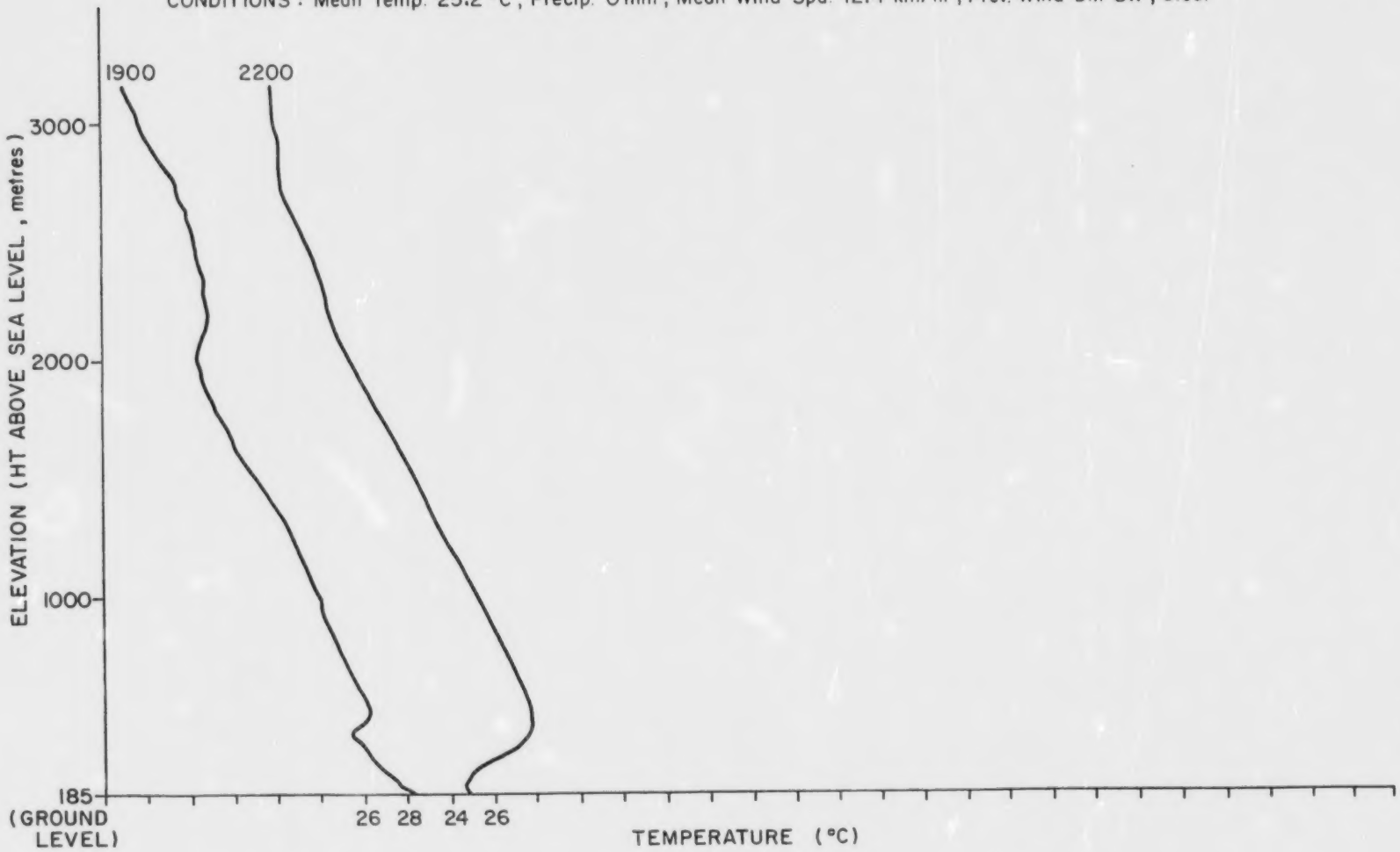


FIGURE 22 MINISONDE TEMPERATURE PROFILES JULY 7, 1986

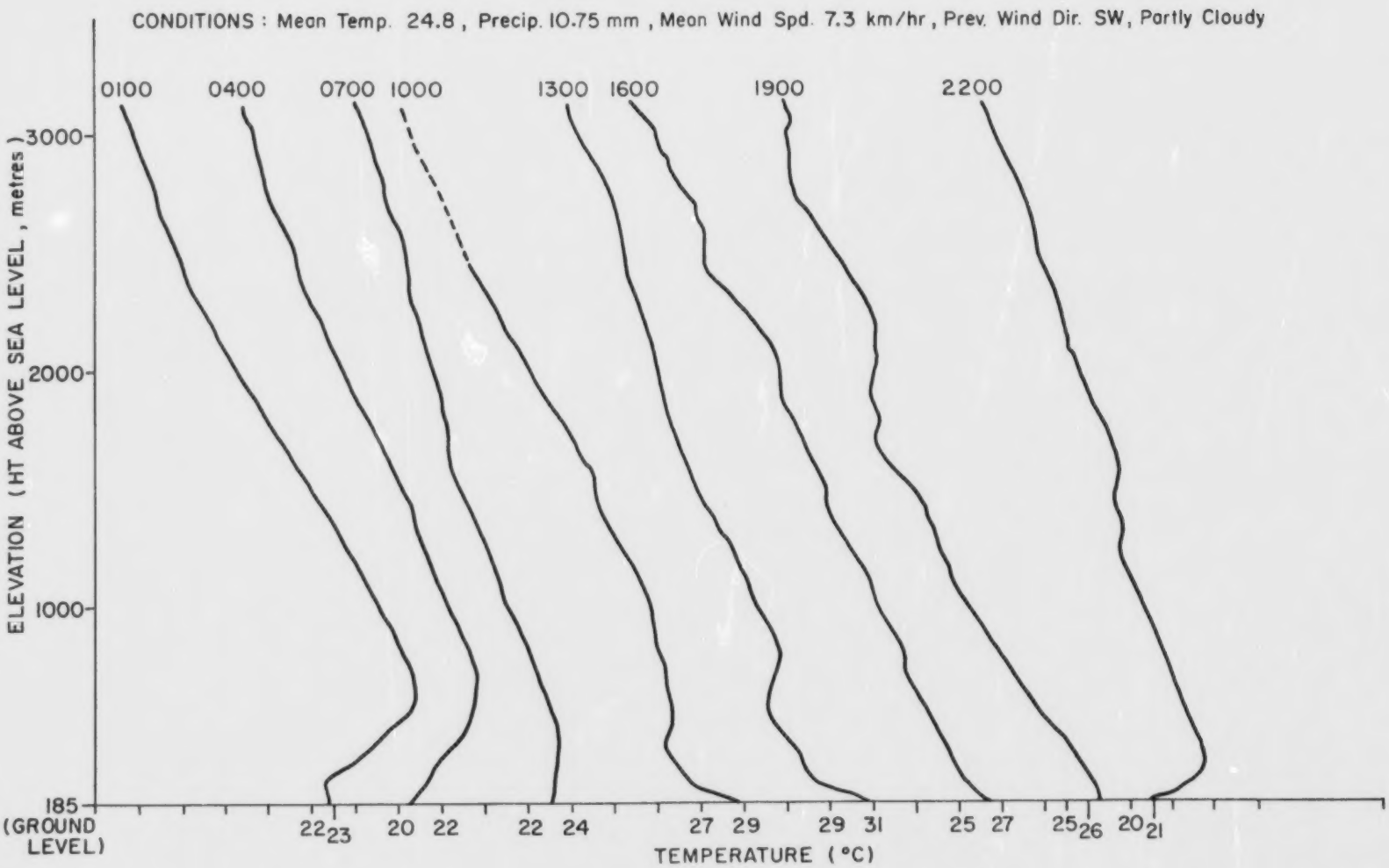


FIGURE 23 MINISONDE TEMPERATURE PROFILES JULY 8, 1986

CONDITIONS: Mean Temp. 20.7 , Precip. 0 mm , Mean Wind Spd. 6.9 km/hr , Prev. Wind Dir. SW , Cloudy

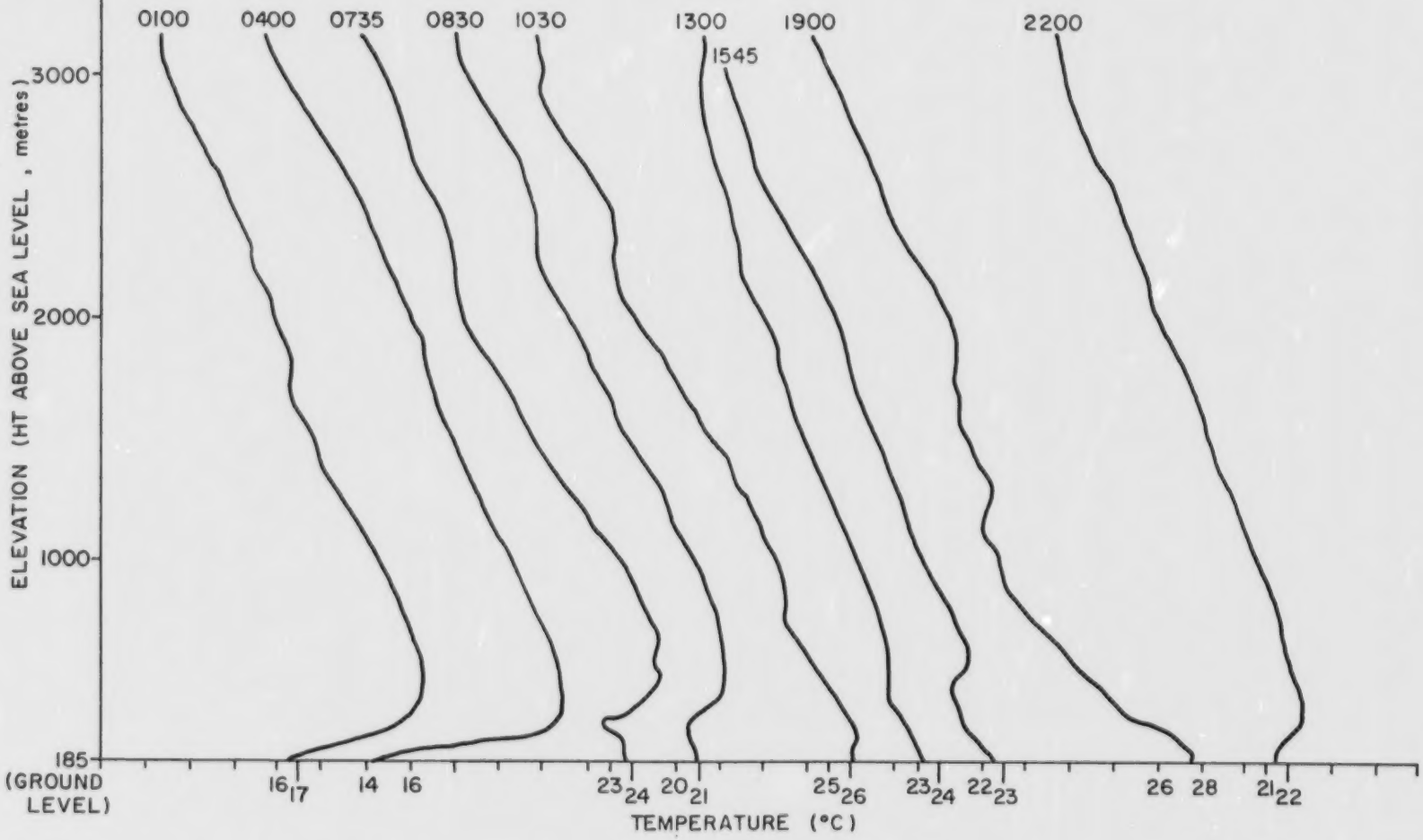


FIGURE 24 MINISONDE TEMPERATURE PROFILES JULY 9, 1986

CONDITIONS: Mean Temp. 20.1 °C, Precip. 0mm, Mean Wind Spd. 6.4 km/hr, Prev. Wind Dir. W, Partly Cloudy

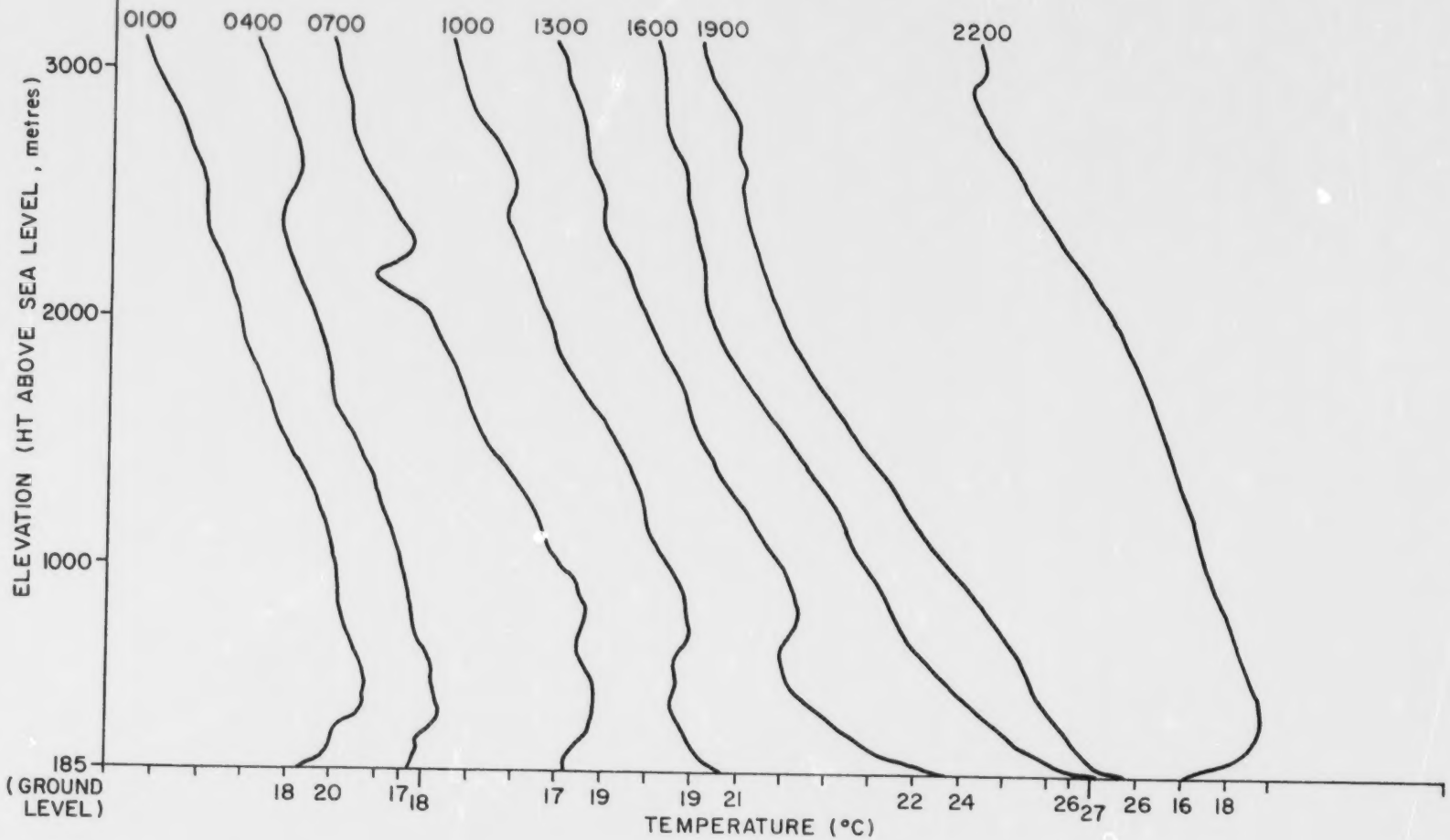


FIGURE 25 MINISONDE TEMPERATURE PROFILES JULY 10, 1986

CONDITIONS: Mean Temp. 17.3 °C, Precip. 0mm, Mean Wind Spd. 5.5 km/hr, Prev. Wind Dir. WNW, Sunny

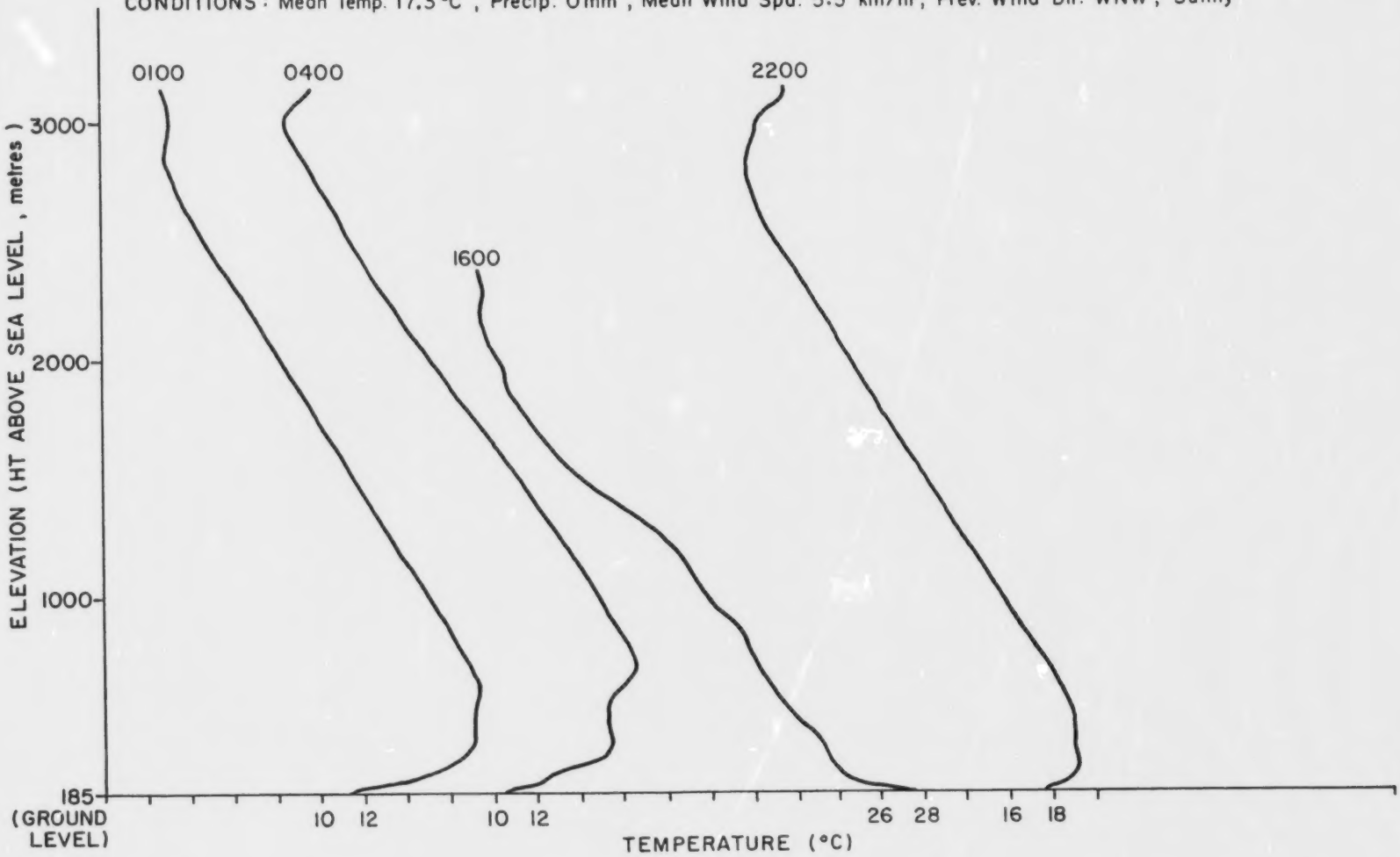


FIGURE 26 MINISONDE TEMPERATURE PROFILES JULY 11, 1986

CONDITIONS : Mean Temp., 16.9 °C , Precip. .5 mm , Mean Wind Spd. 5.7 km/hr , Prev. Wind Dir. N , Cloudy

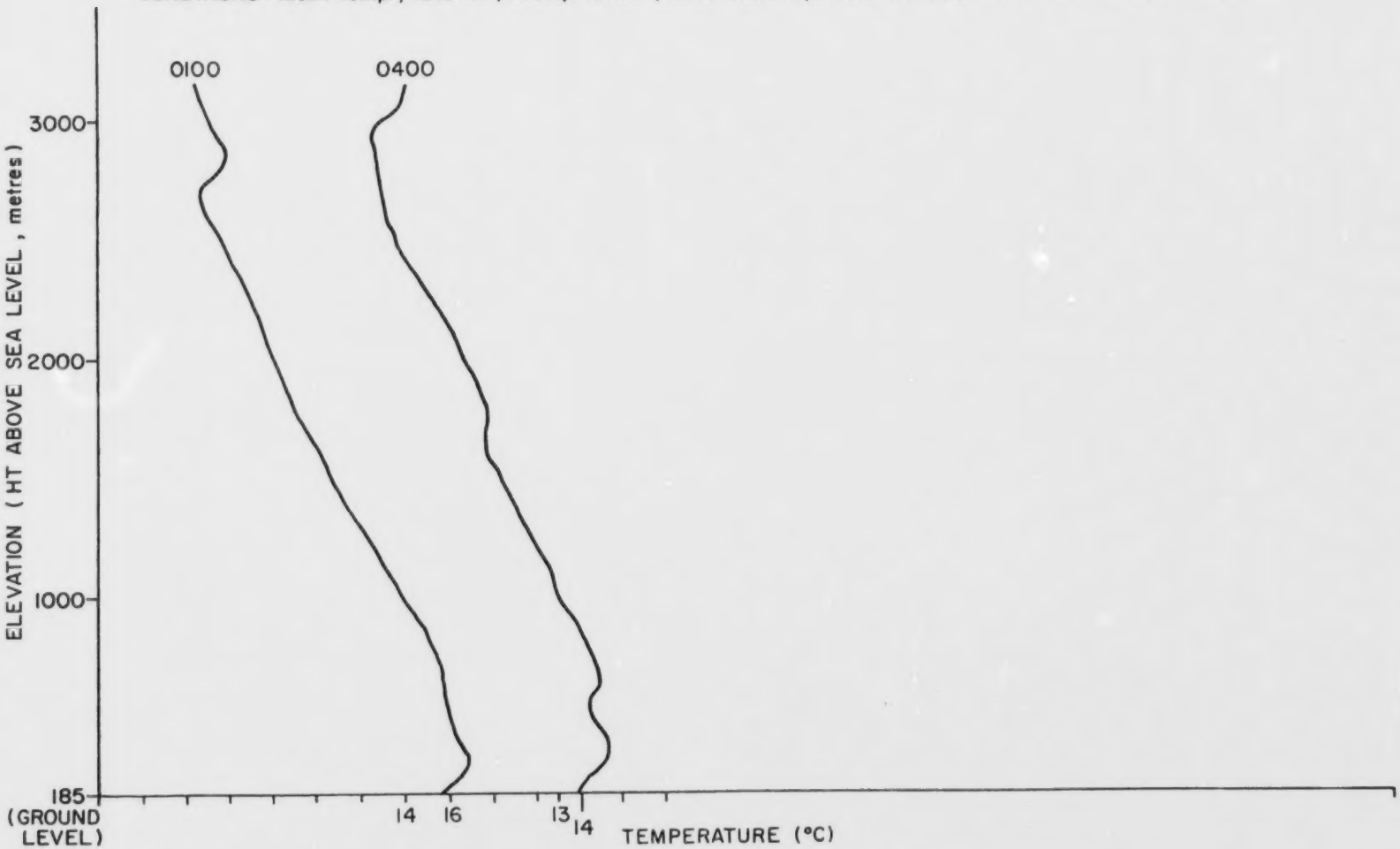


FIGURE 27 MINISONDE TEMPERATURE PROFILES JULY 14, 1986

CONDITIONS: Mean Temp., 19.1 °C, Precip. 0 mm, Mean Wind Spd. 10.1 km/hr, Prev. Wind Dir. SW, Clear

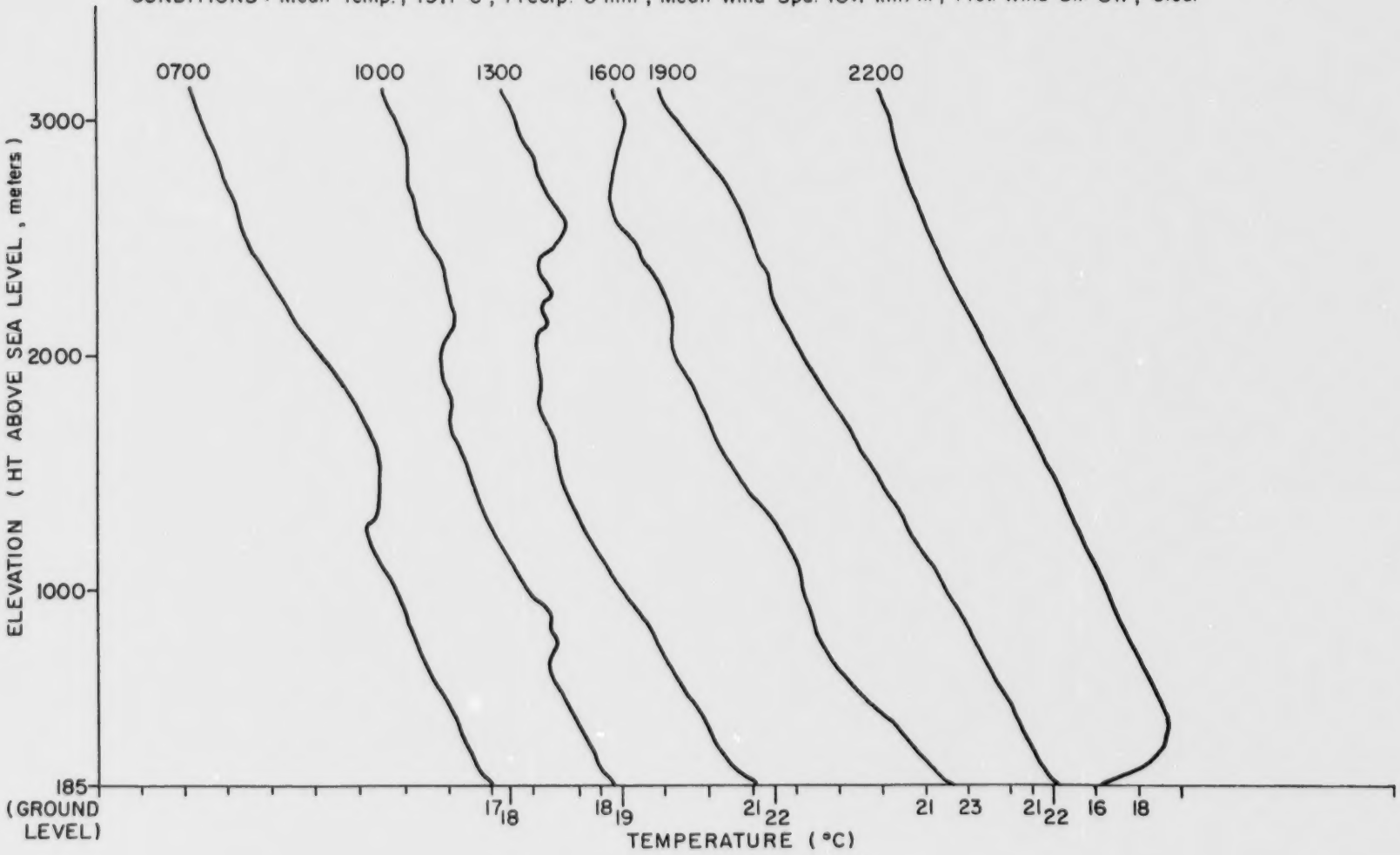


FIGURE 28 MINISONDE TEMPERATURE PROFILES JULY 15, 1986

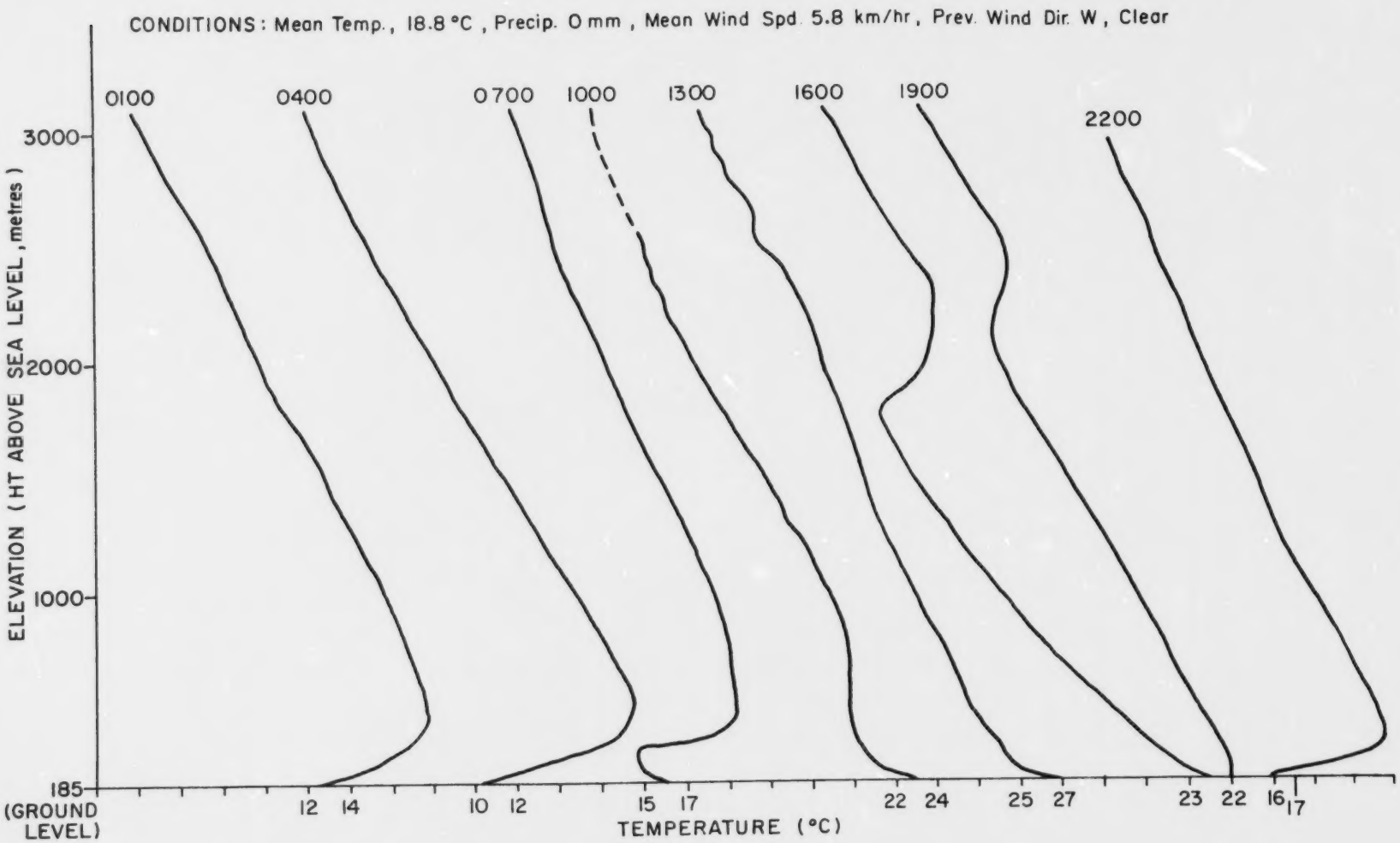


FIGURE 29 MINISONDE TEMPERATURE PROFILES JULY 16, 1986

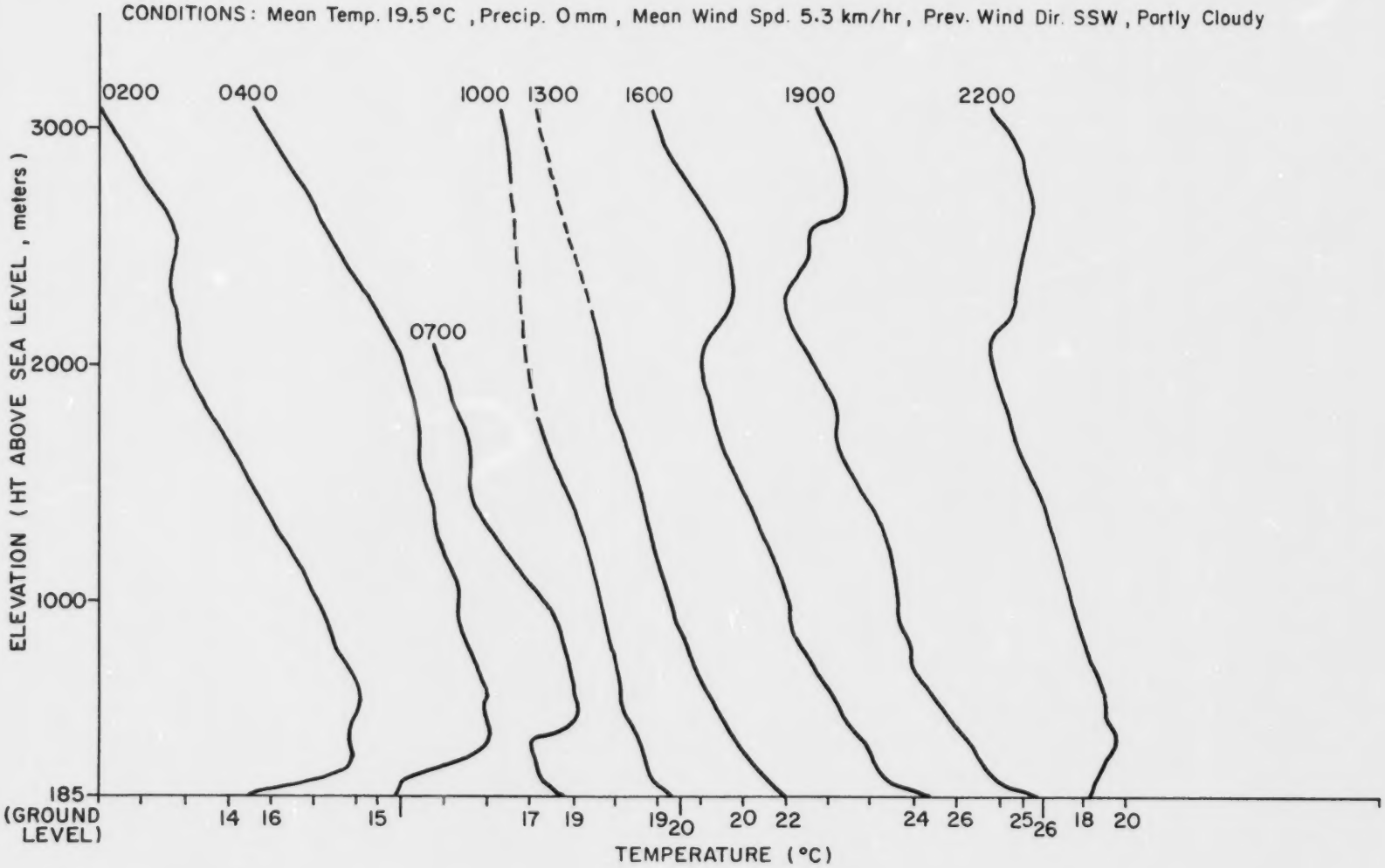


FIGURE 30 MINISONDE TEMPERATURE PROFILES JULY 17, 1986

CONDITIONS: Mean Temp. 21.3°C, Precip. 13.25 mm, Mean Wind Spd. 5.3 km/hr, Prev Wind Dir. SW, Partly Cloudy

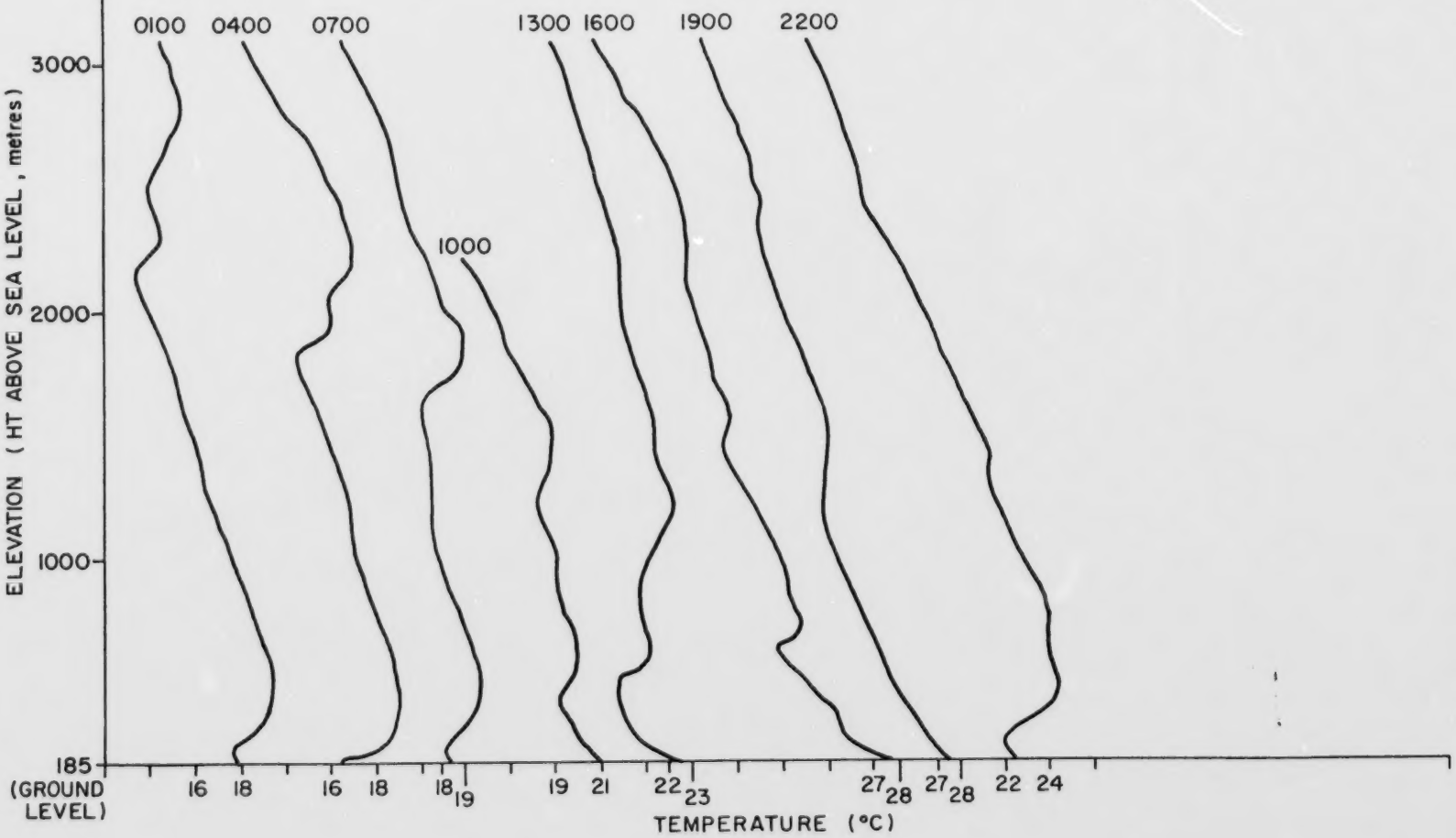


FIGURE 31 MINISONDE TEMPERATURE PROFILES JULY 18, 1986

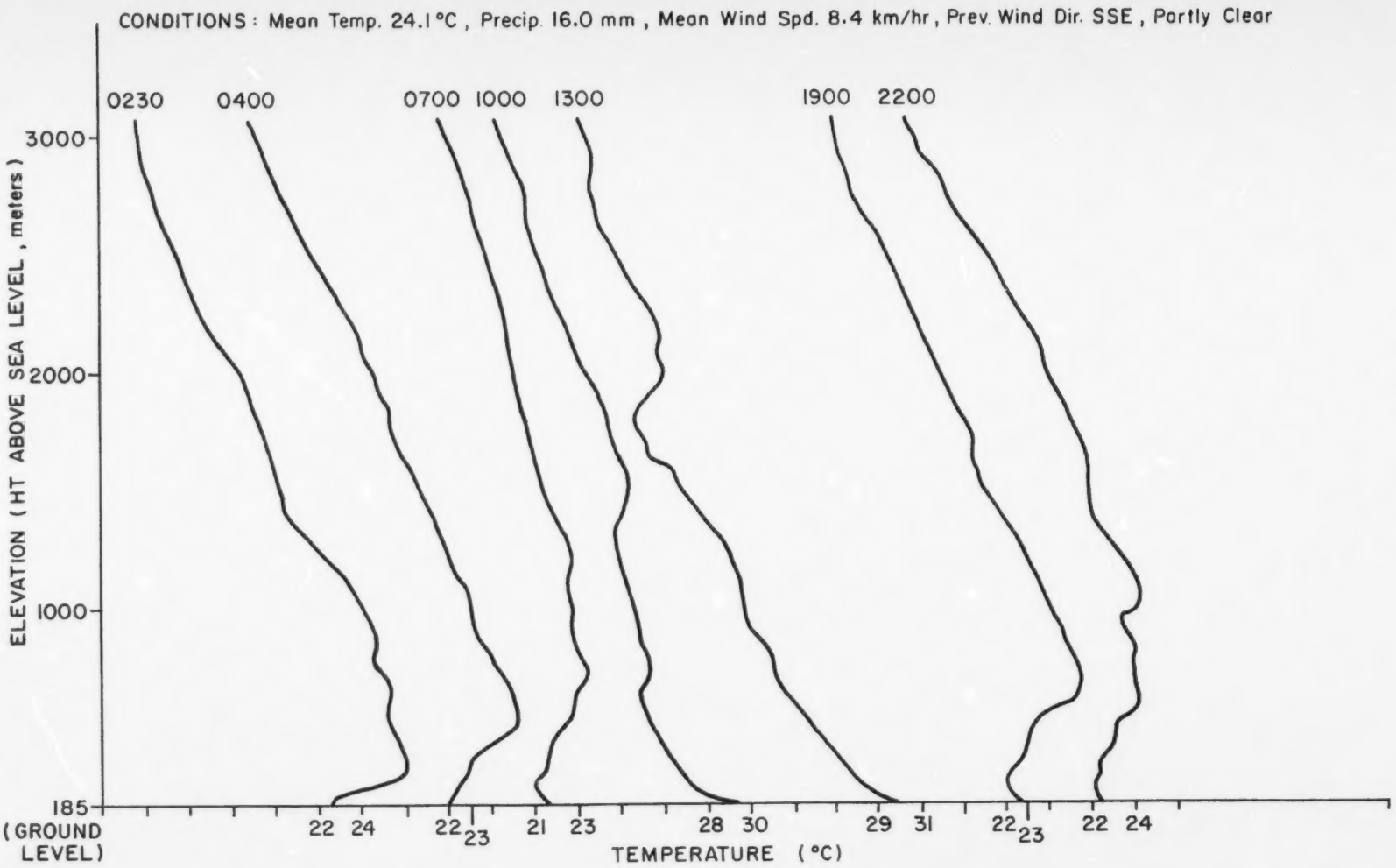


FIGURE 32 MINISONDE TEMPERATURE PROFILES JULY 19, 1986

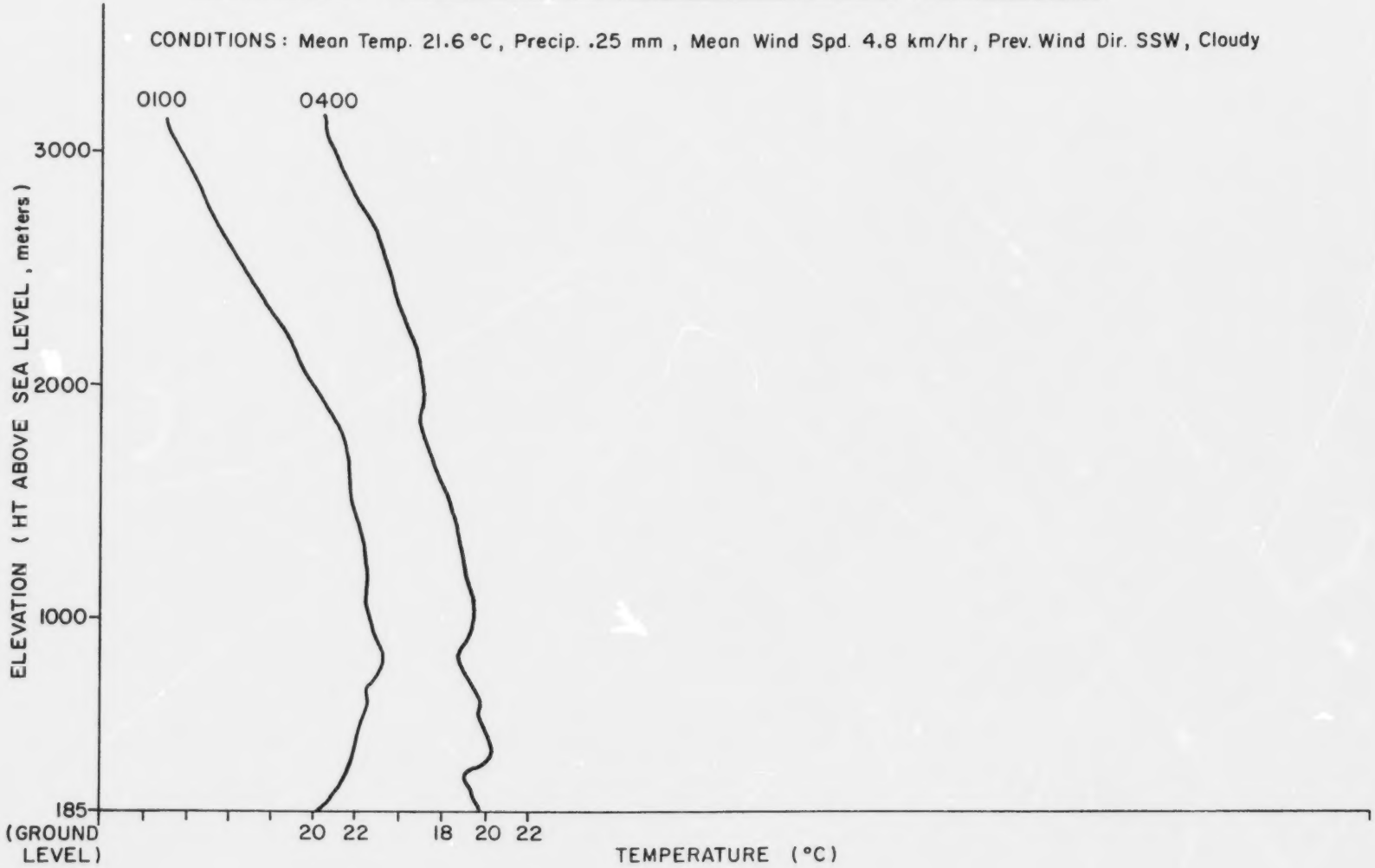


FIGURE 33 . MINISONDE TEMPERATURE PROFILES DATE : MON., OCT. 6 , 1986

CONDITIONS : Mean Temp. 7.3°C , Precip. 0 mm , Mean Wind Spd. 15.4 km / hr , Prev. Wind Dir. W-WNW, Partly Cloudy

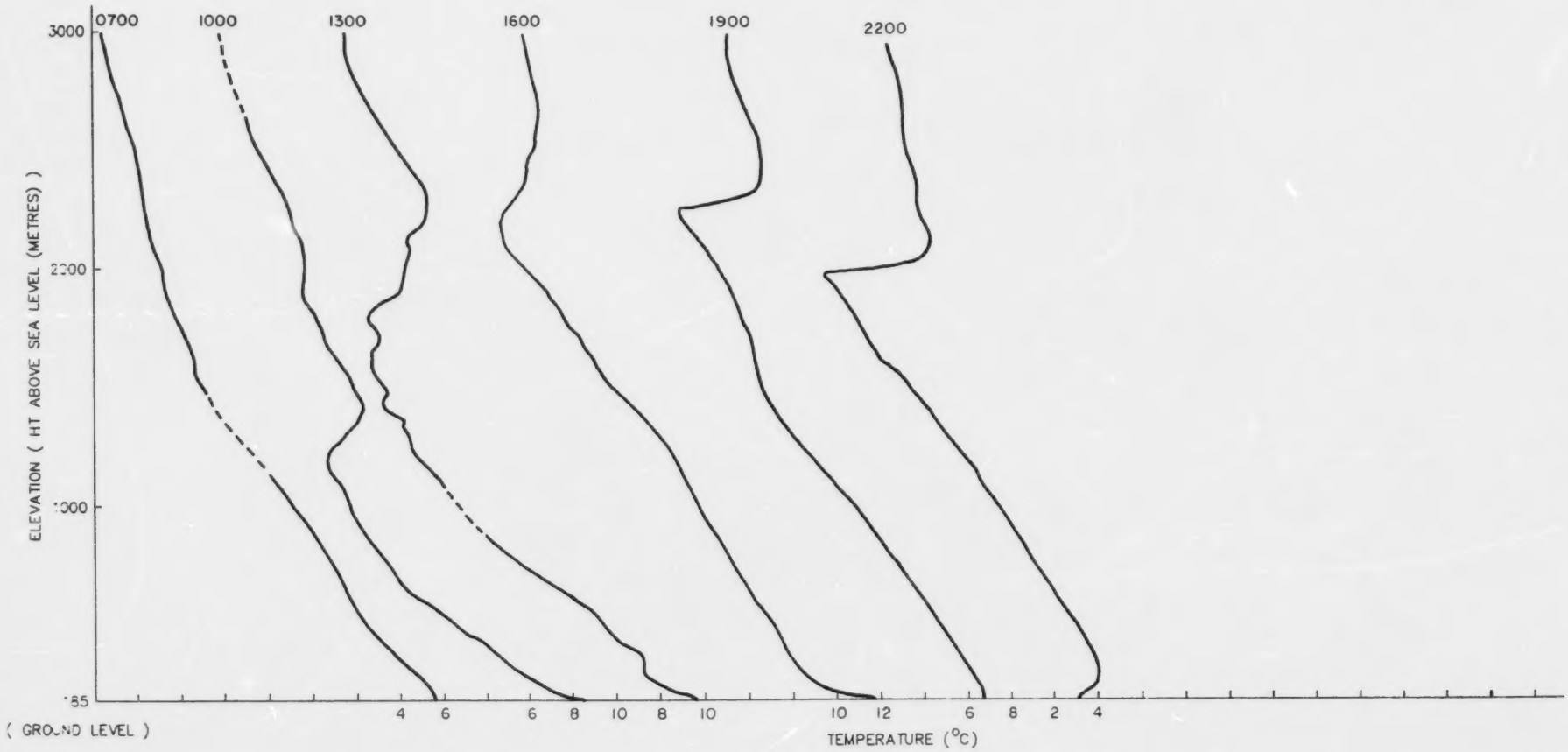


FIGURE 34 . MINISONDE TEMPERATURE PROFILES DATE : TUES., OCT. 7, 1986

CONDITIONS: Mean Temp. 10.0°C, Precip. 0 mm, Mean Wind Spd. 12.1 km/hr, Prev. Wind Dir. SW-WSW, Clear

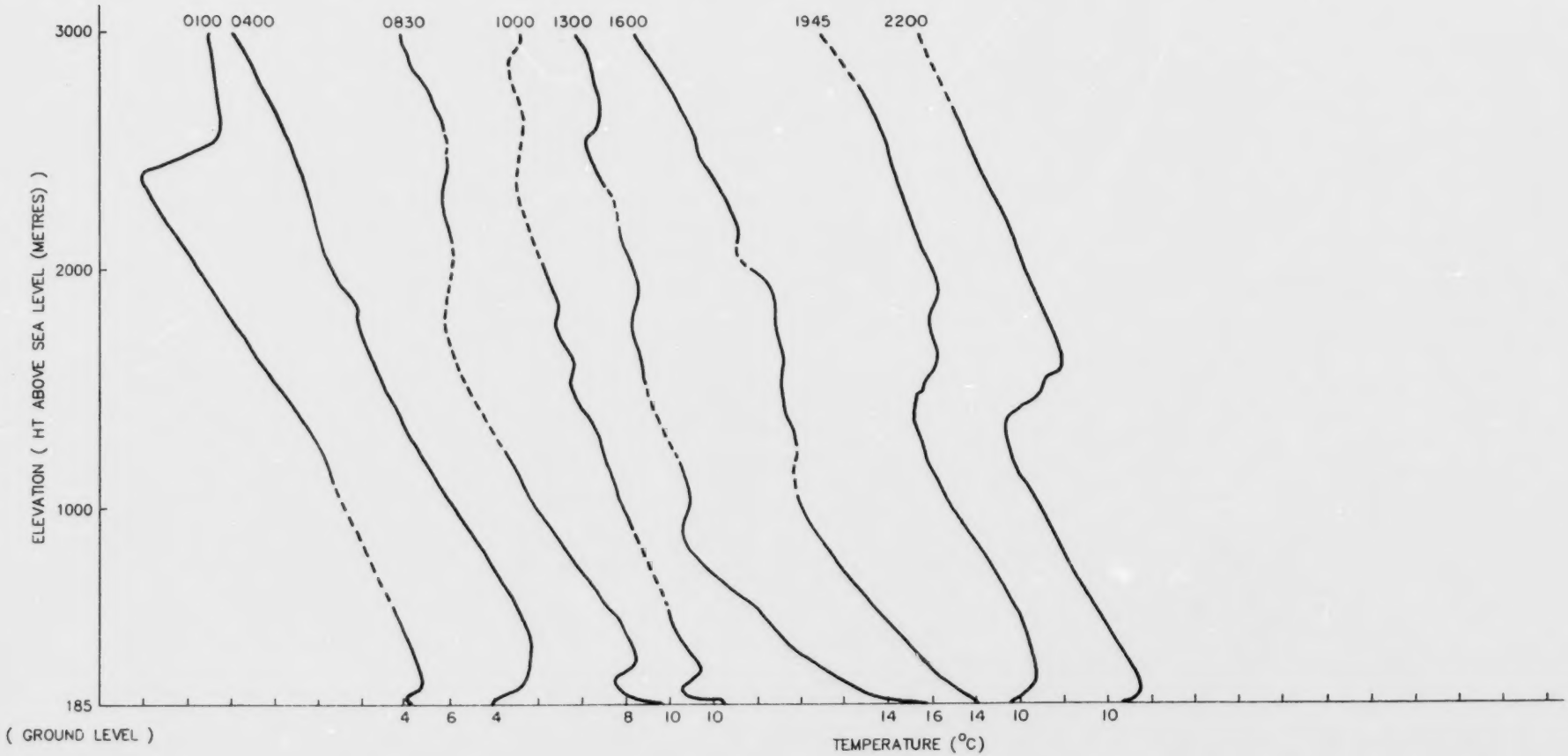


FIGURE 35 . MINISONDE TEMPERATURE PROFILES DATE : WED., OCT . 8 , 1986

CONDITIONS : Mean Temp. 15.4°C , Precip..25 mm , Mean Wind Spd. 18.7 km/hr , Prev. Wind Dir. SW , Overcast

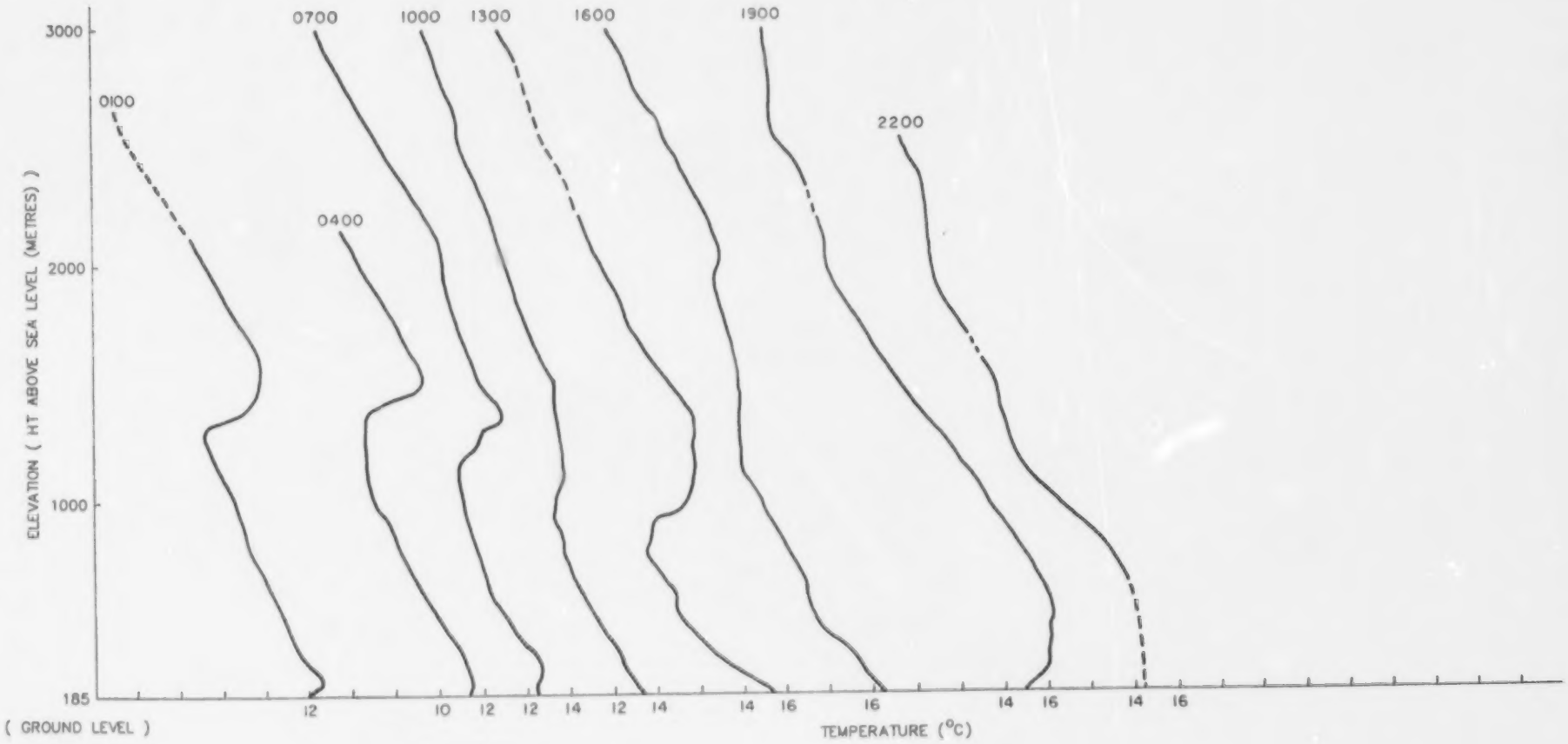


FIGURE 36 . MINISONDE TEMPERATURE PROFILES DATE : THURS., OCT. 9 , 1986

CONDITIONS: Mean Temp. 8.5 °C , Precip. 4.50 mm , Mean Wind Speed 12.4 km/hr , Prev. Wind Dir. N , Partly Cloudy

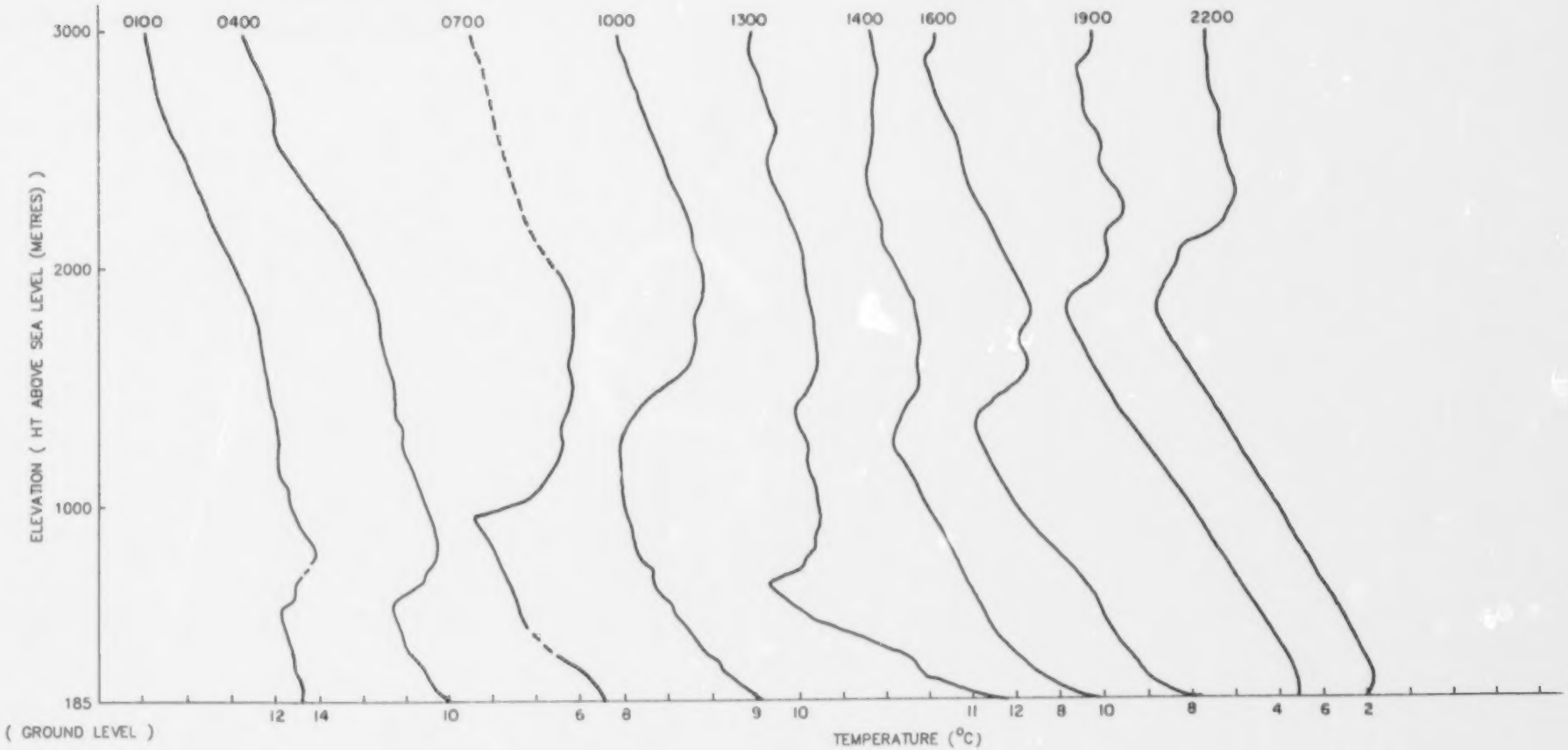


FIGURE 37 . MINISONDE TEMPERATURE PROFILES DATE : FRI., OCT. 10 , 1986

CONDITIONS: Mean Temp. 5.3°C , Precip. 0mm , Mean Wind Speed 9.7 km/hr , Pr. Wind Dir. E-ENE , Partly Cloudy

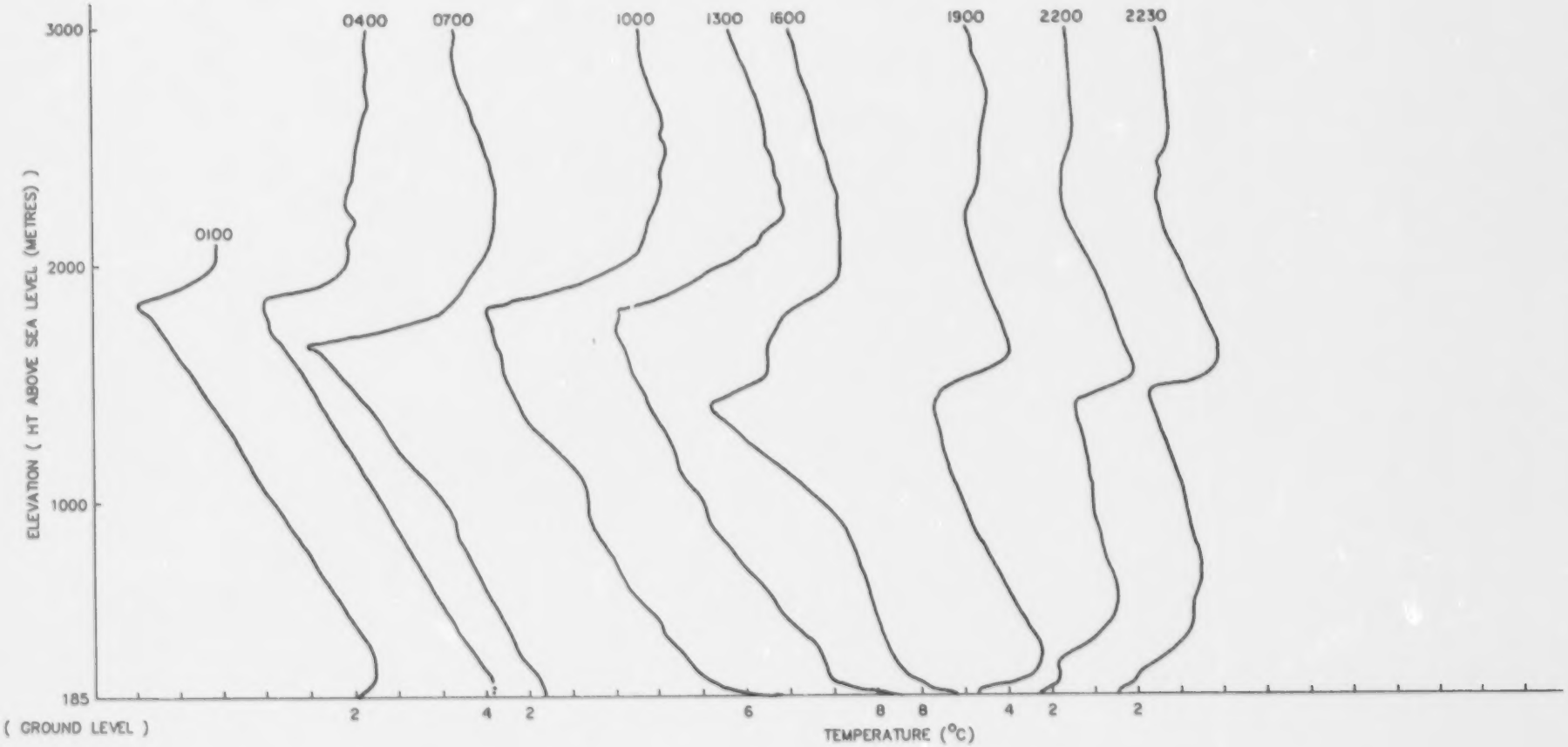


FIGURE 38 MINISONDE TEMPERATURE PROFILES DATE : SAT., OCT. 11 , 1986

CONDITIONS : Mean Temp. 9.1°C , Precip. 0 mm , Mean Wind Spd. 6.9 km / hr , Prev. Wind Dir. SSE-SSW , Partly Cloudy

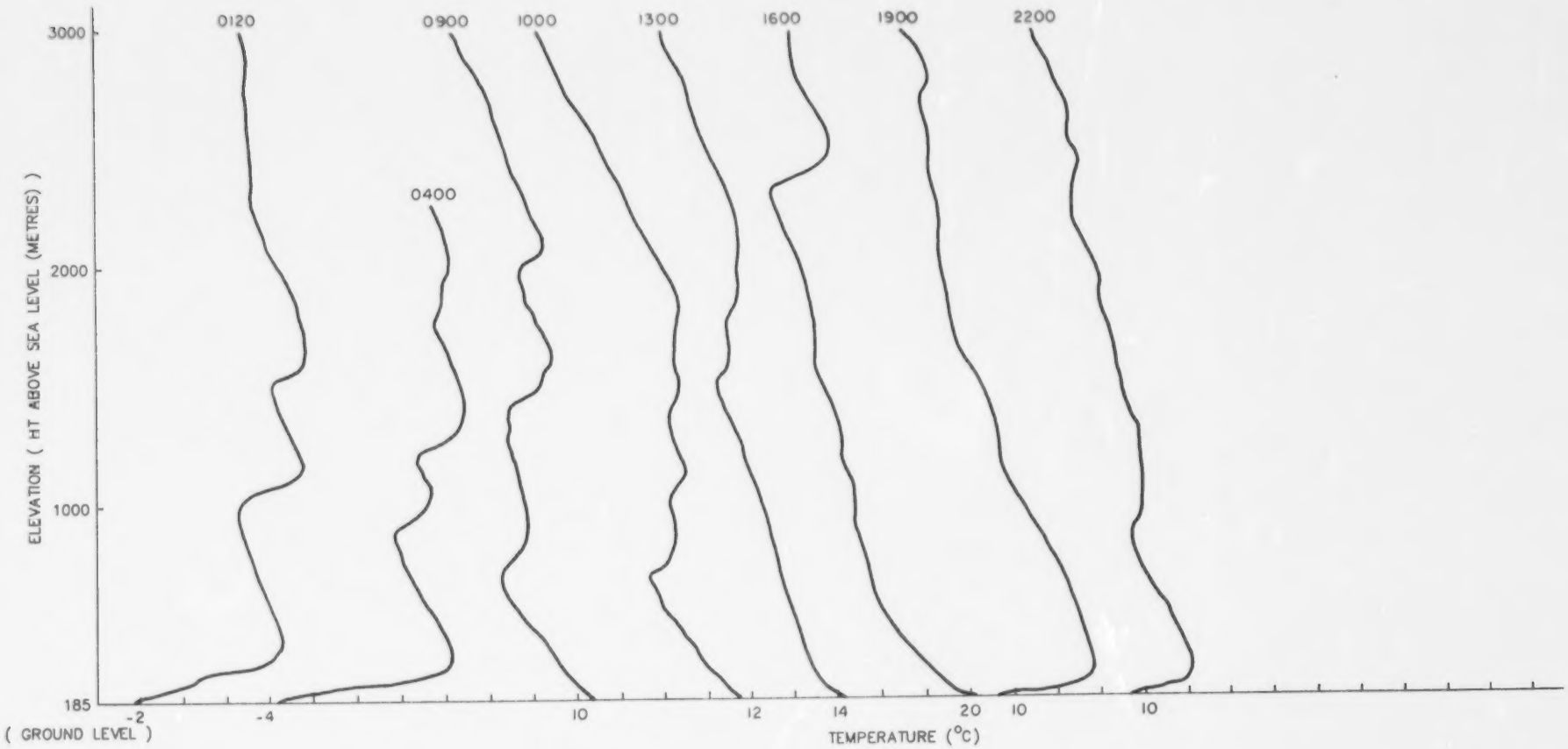


FIGURE 39 MINISONDE TEMPERATURE PROFILES DATE : SUN., OCT. 12, 1986

CONDITIONS : Mean Temp. 14.9°C, Precip. .75 mm, Mean Wind Spd. 7.3 km/hr, Prev. Wind Dir. S, Partly Cloudy.

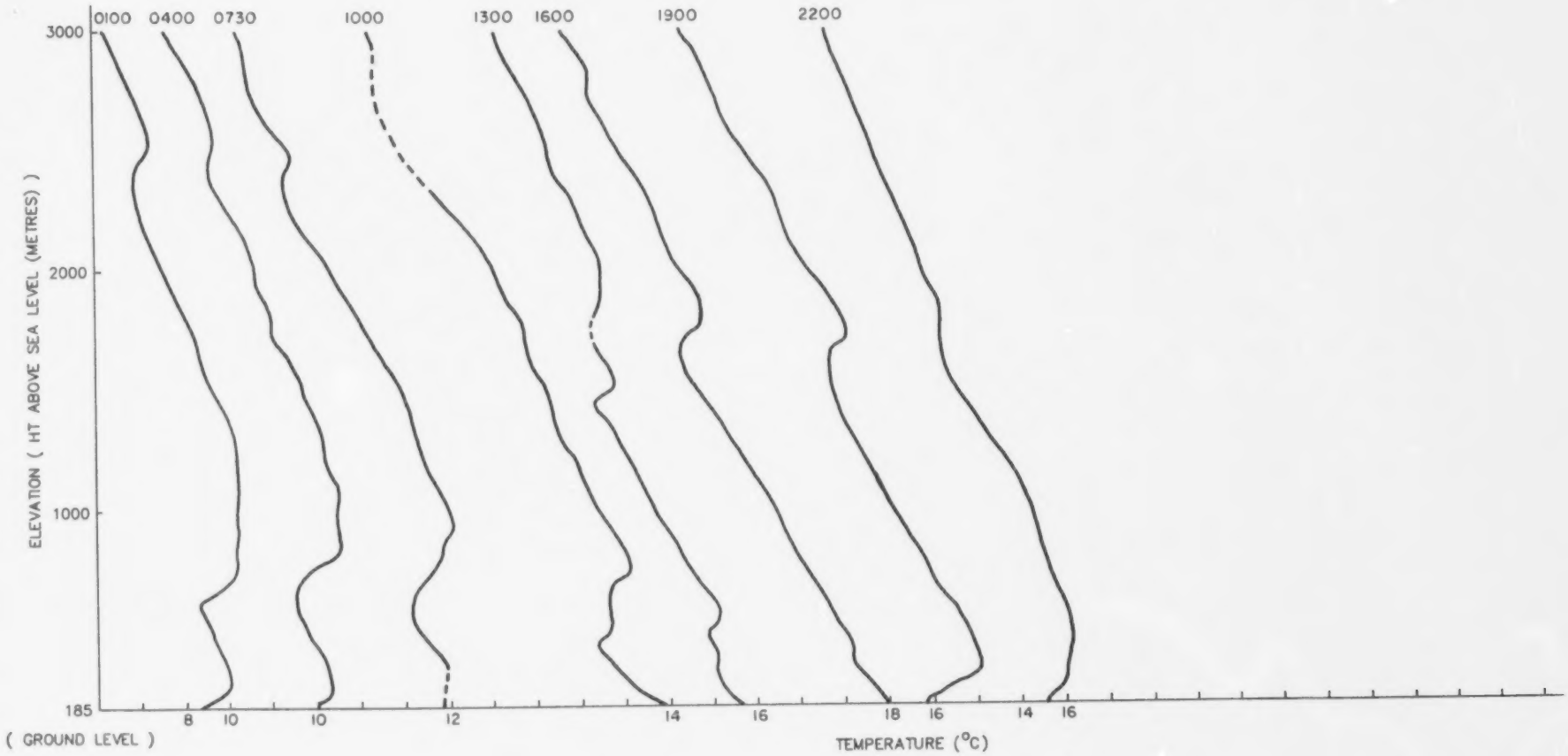


FIGURE 40 . MINISONDE TEMPERATURE PROFILES DATE : MON., OCT. 13, 1986

CONDITIONS: Mean Temp. 16 °C , Precip 10.25 mm , Mean Wind Speed 7.6 km/hr , Prev Wind Dir. Variable , Overcast .

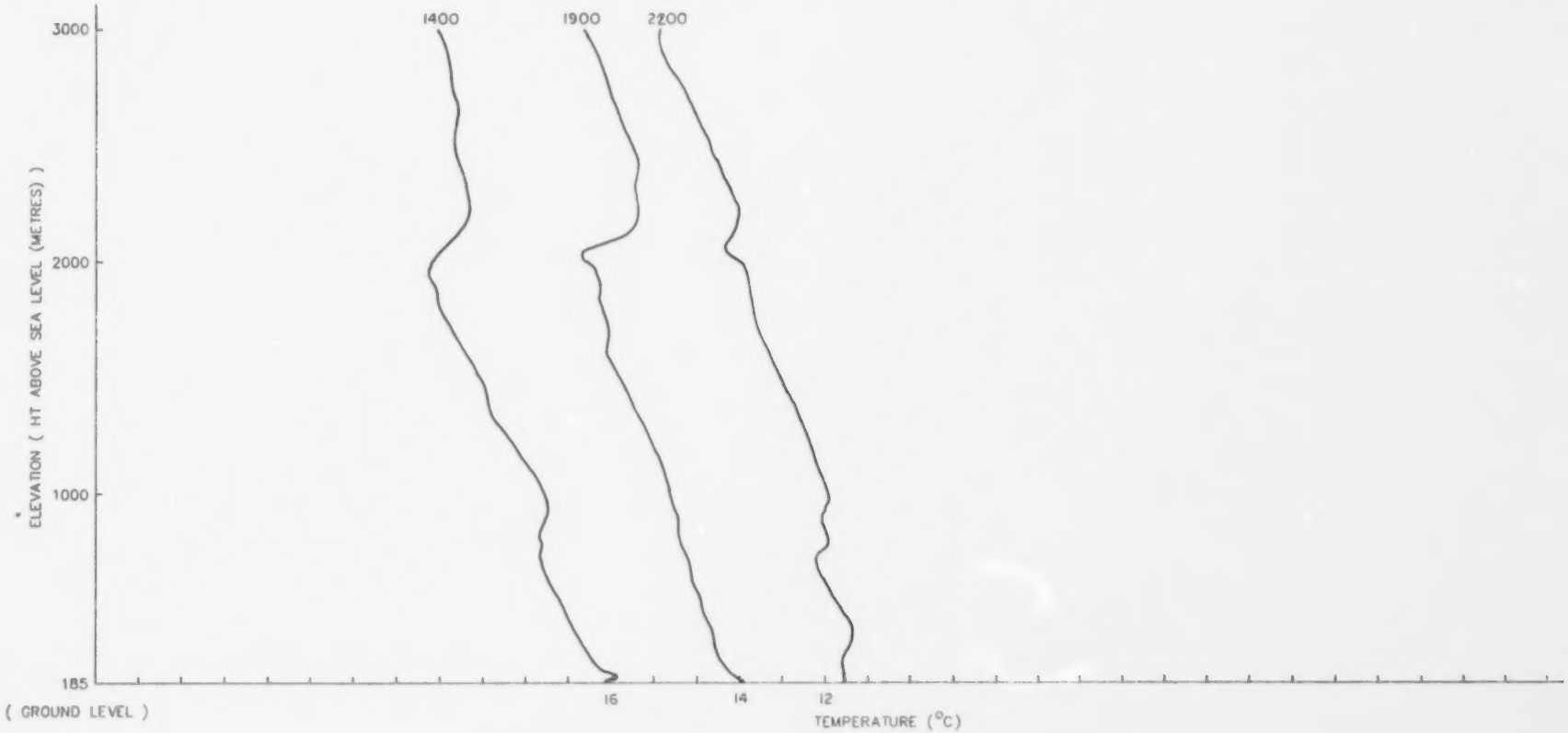


FIGURE 41 . MINISONDE TEMPERATURE PROFILES DATE : TUES., OCT. 14 , 1986

CONDITIONS: Mean Temp. 12.0 °C , Precip. 2.25 mm , Mean Wind Speed 17.5 km/hr. , Prev. Wind Dir. WSW , Overcast .

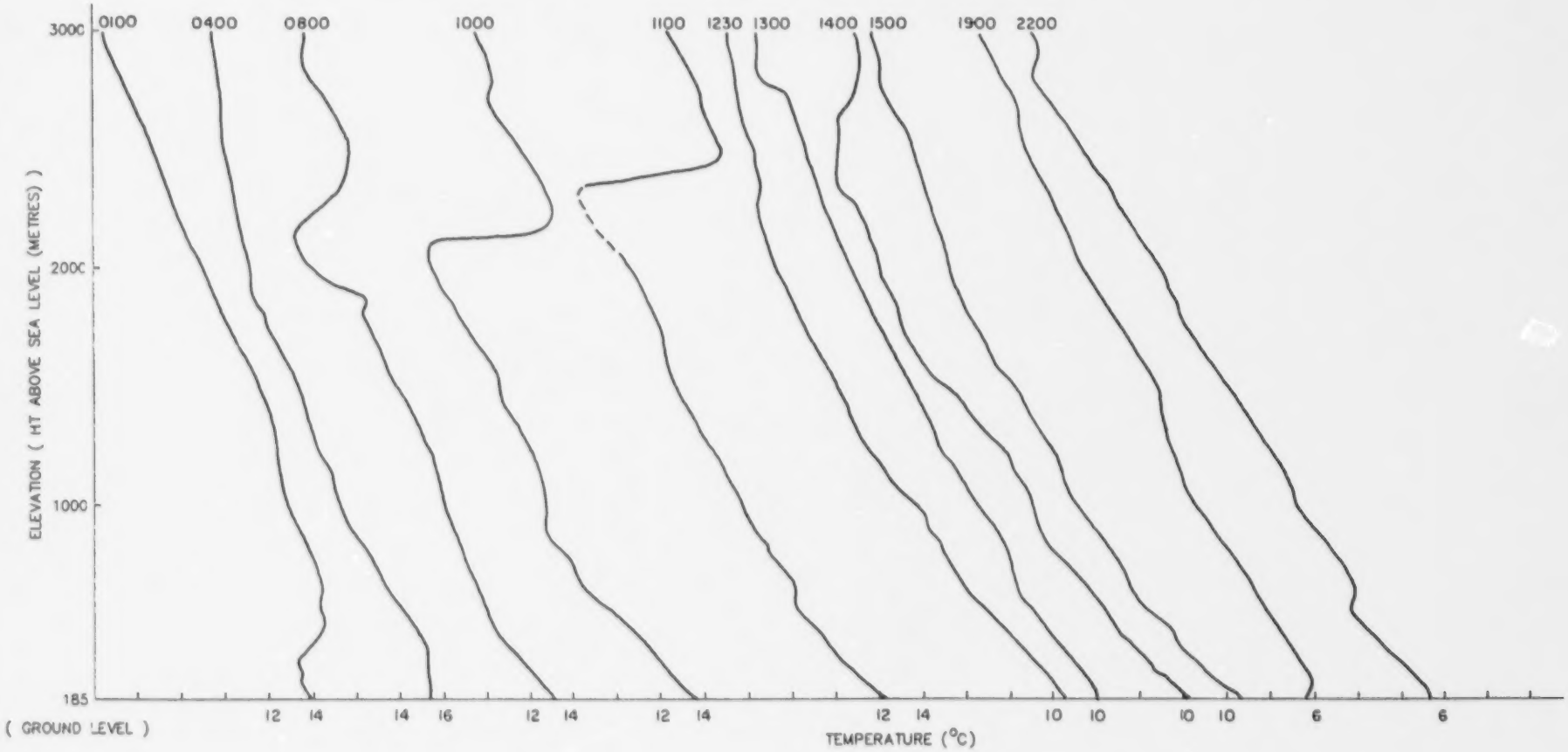


FIGURE 42 . MINISONDE TEMPERATURE PROFILES DATE : WED., OCT. 15, 1986.

CONDITIONS: Mean Temp. 7.1 °C , Precip. 0 mm , Mean Wind Speed 14.2 km/hr , Prev. Wind Dir. W , Partly Cloudy

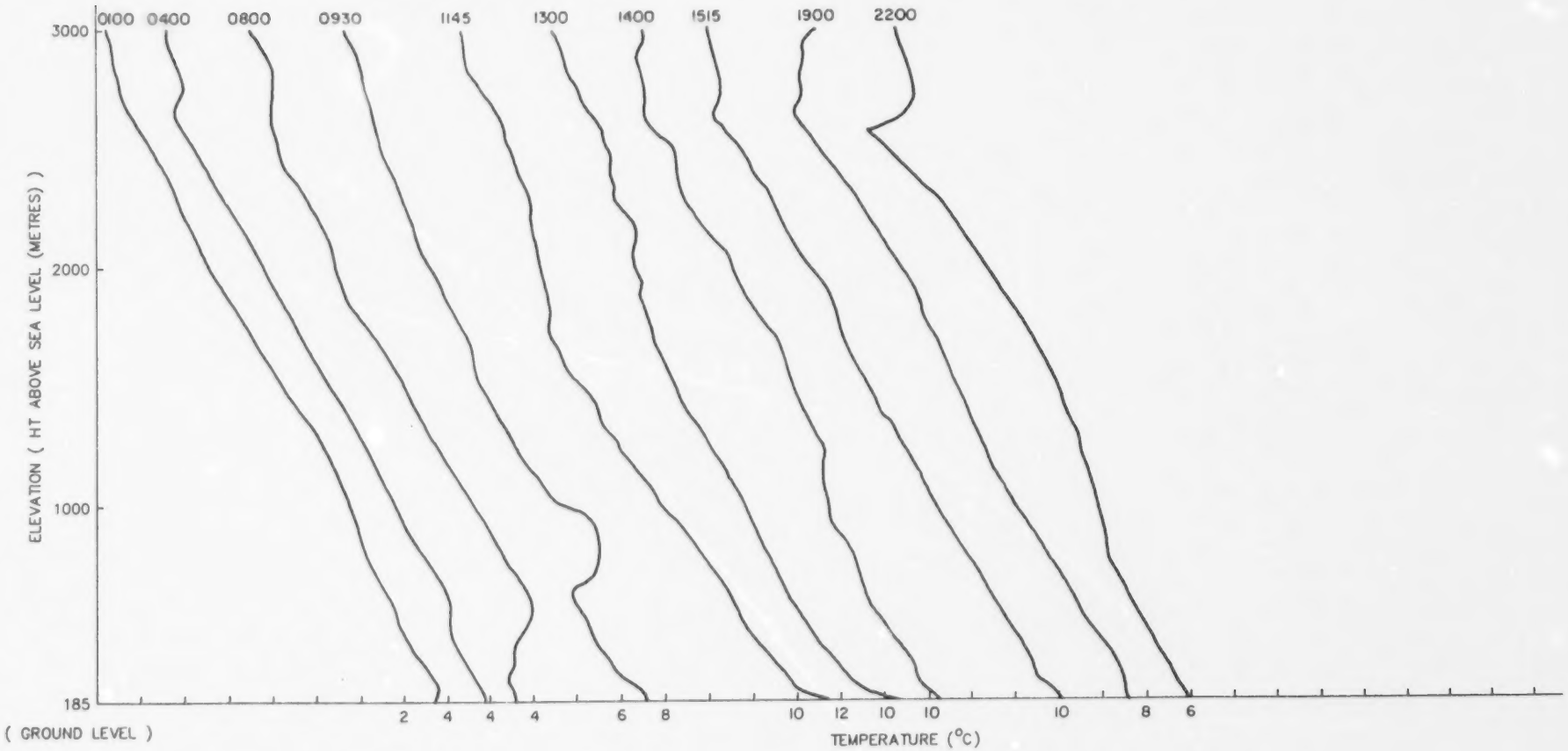


FIGURE 43 . MINISONDE TEMPERATURE PROFILES DATE : THUR., OCT. 16, 1986

CONDITIONS : Mean Temp. 7.4°C, Precip. .25 mm, Mean Wind Spd. 4.1 km/hr, Prev. Wind Dir. Calm, Overcast.

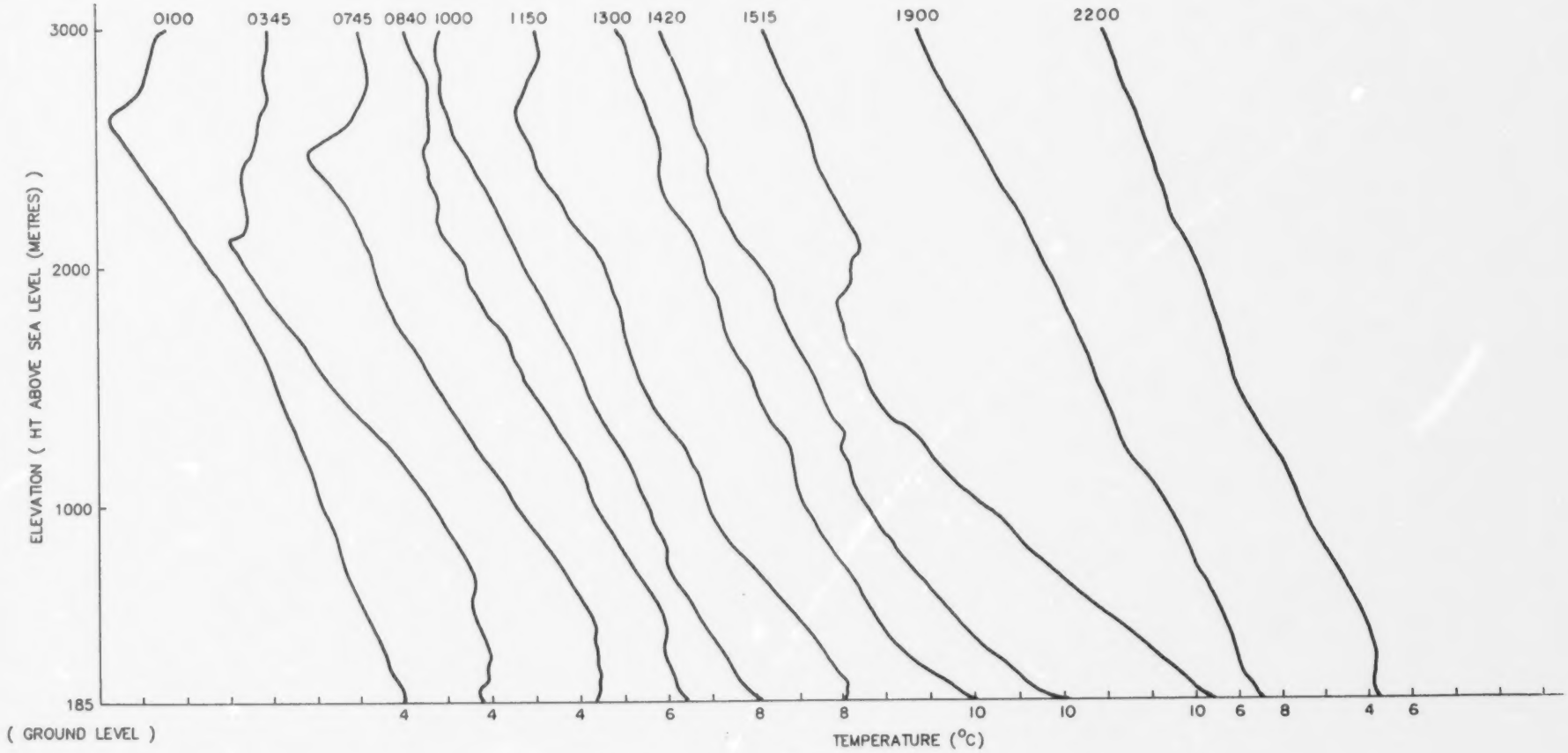


FIGURE 44 . MINISONDE TEMPERATURE PROFILES DATE : FRI., OCT. 17, 1986

CONDITIONS : Mean Temp. 7.1 °C, Precip. 1.75 mm, Mean Wind Spd. 6.4 km/hr, Prev. Wind Dir. NE, Overcast

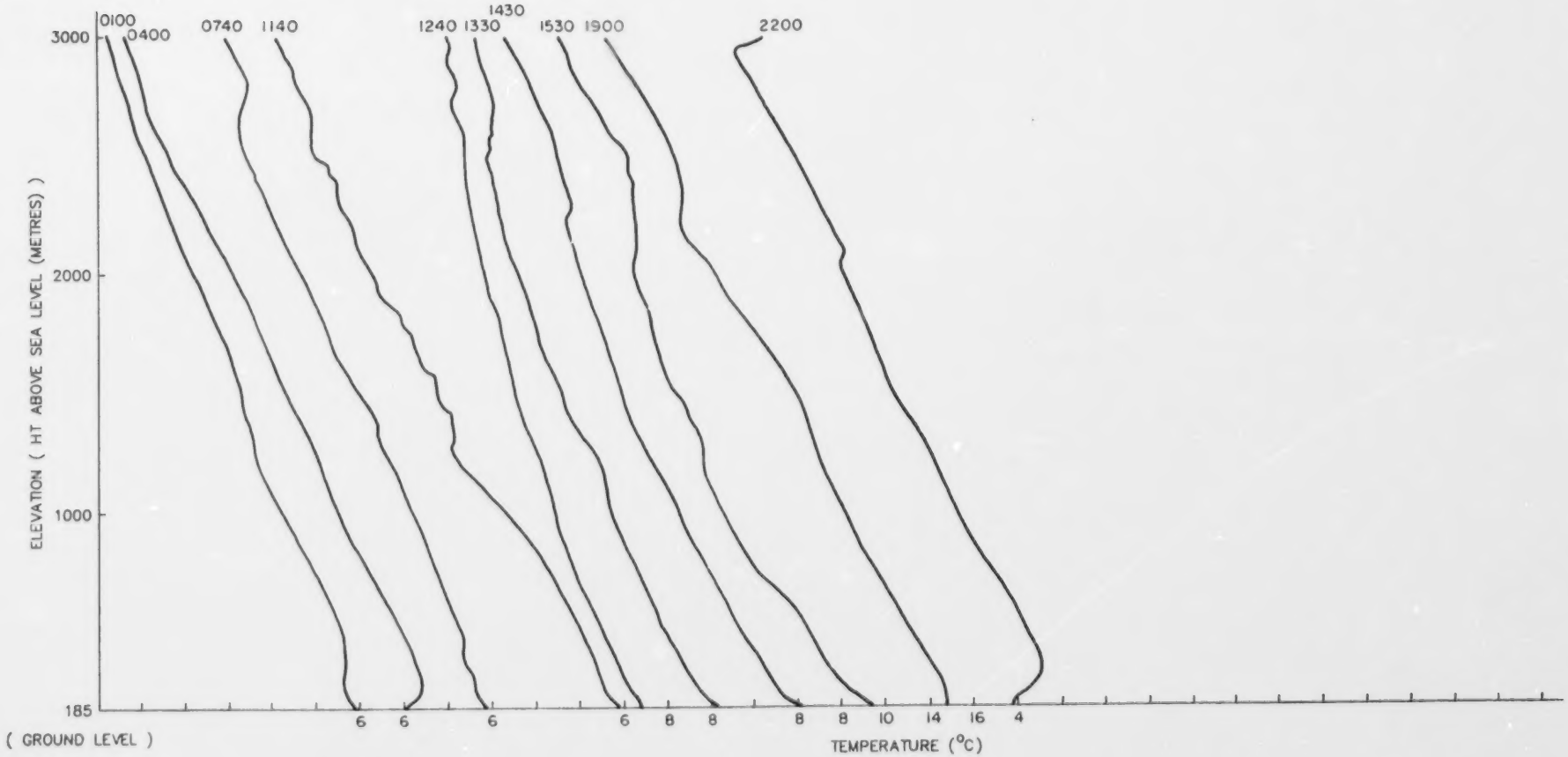


FIGURE 45 MINISONDE TEMPERATURE PROFILES DATE : SAT., OCT. 18, 1986

CONDITIONS : Mean Temp. 6.0°C, Precip. 0 mm, Mean Wind Spd. 3.1 km/hr, Prev. Wind Dir. Calm, Clear.

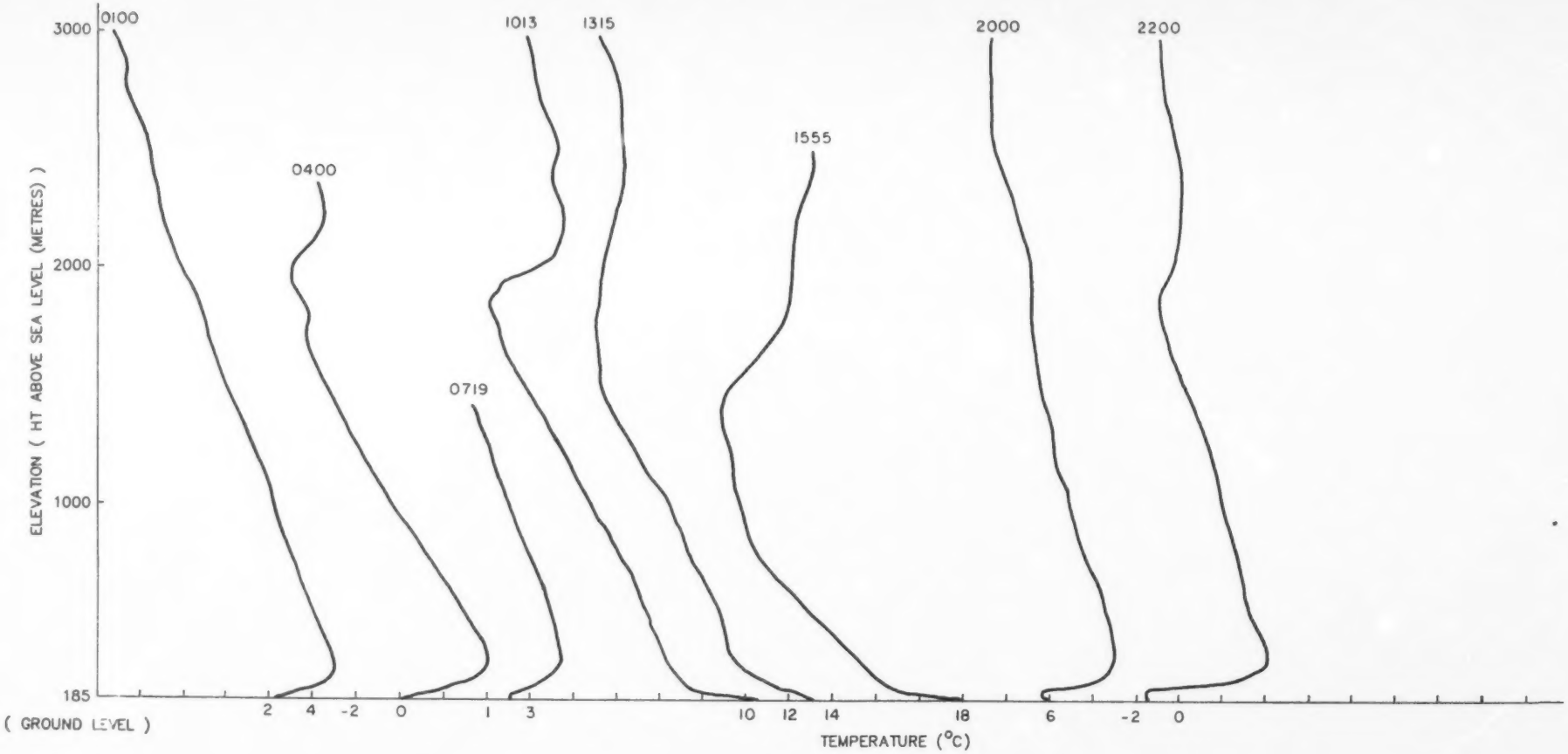


FIGURE 46

MINISONDE TEMPERATURE PROFILES

DATE : SUN., OCT. 19 , 1986

CONDITIONS : Mean Temp. 7.0° C , Precip. 0 mm , Mean Wind Spd. 4.9 km / hr , Prev. Wind Dir. WSW-WNW , Clear.

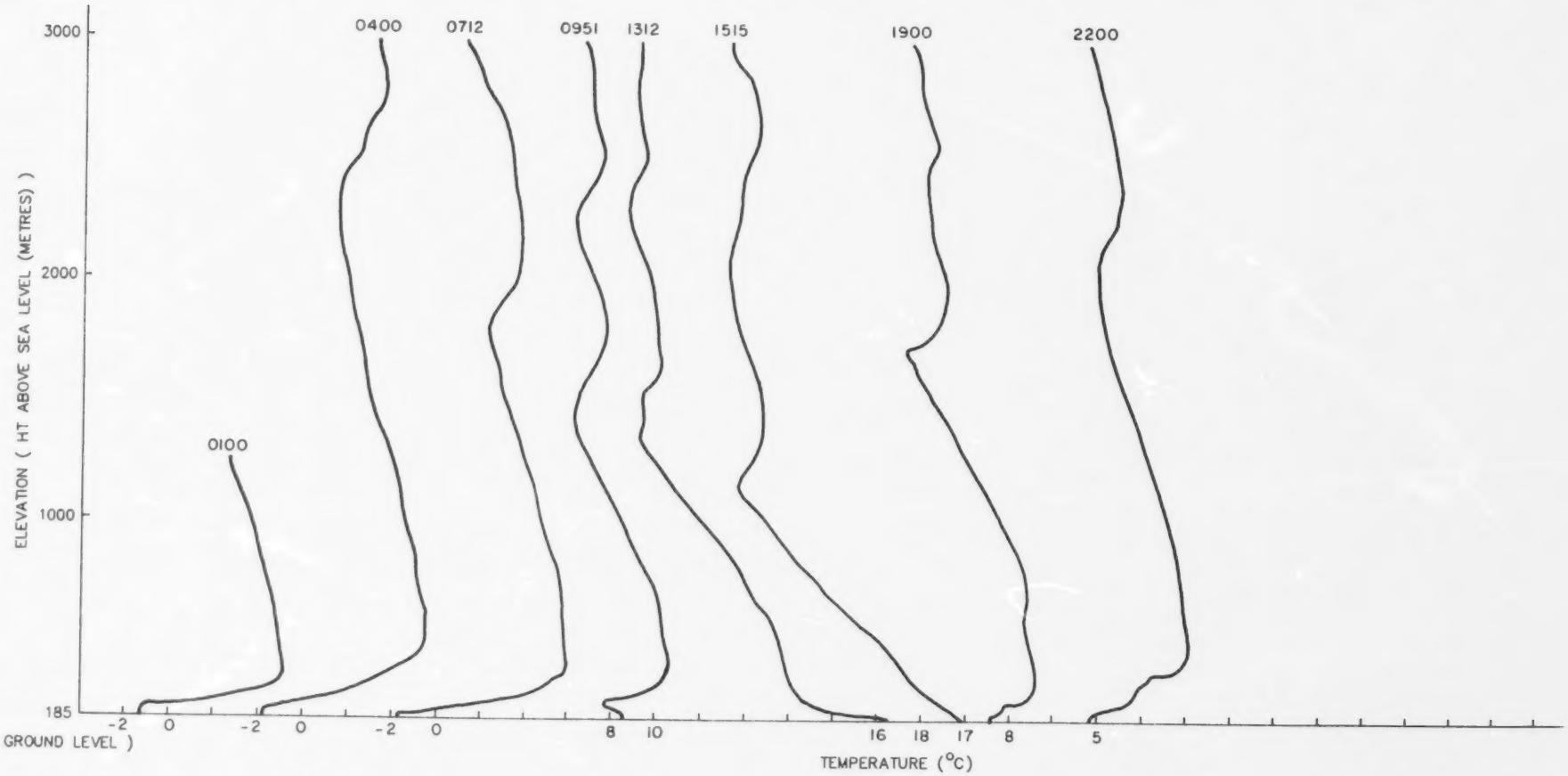


FIGURE 47 . MINISONDE TEMPERATURE PROFILES DATE : MON., OCT. 20, 1986

CONDITIONS: Mean Temp. 9.6°C, Precip. 0 mm, Mean Wind Spd. 9.1 km/hr, Prev. Wind Dir. WSW-SW, Clear

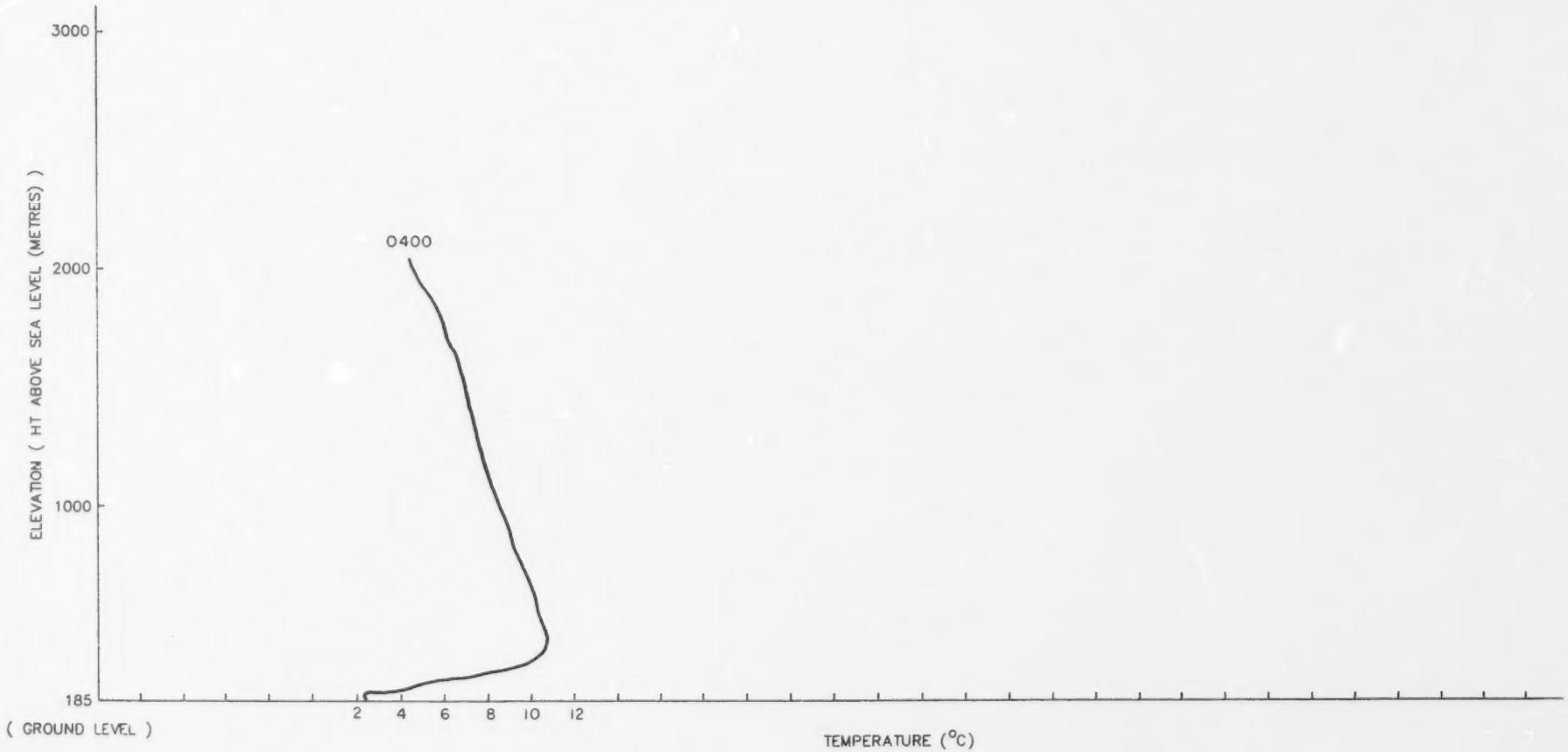


FIGURE 48 .

MINISONDE TEMPERATURE PROFILES

DATE : JAN. 6, 1987

CONDITIONS : Mean Temp. 0.5°C , Precip. 0 mm, Mean Wind Spd. 8.0 km/hr , Prev. Wind Dir. SSE-SSW, Partly Cloudy

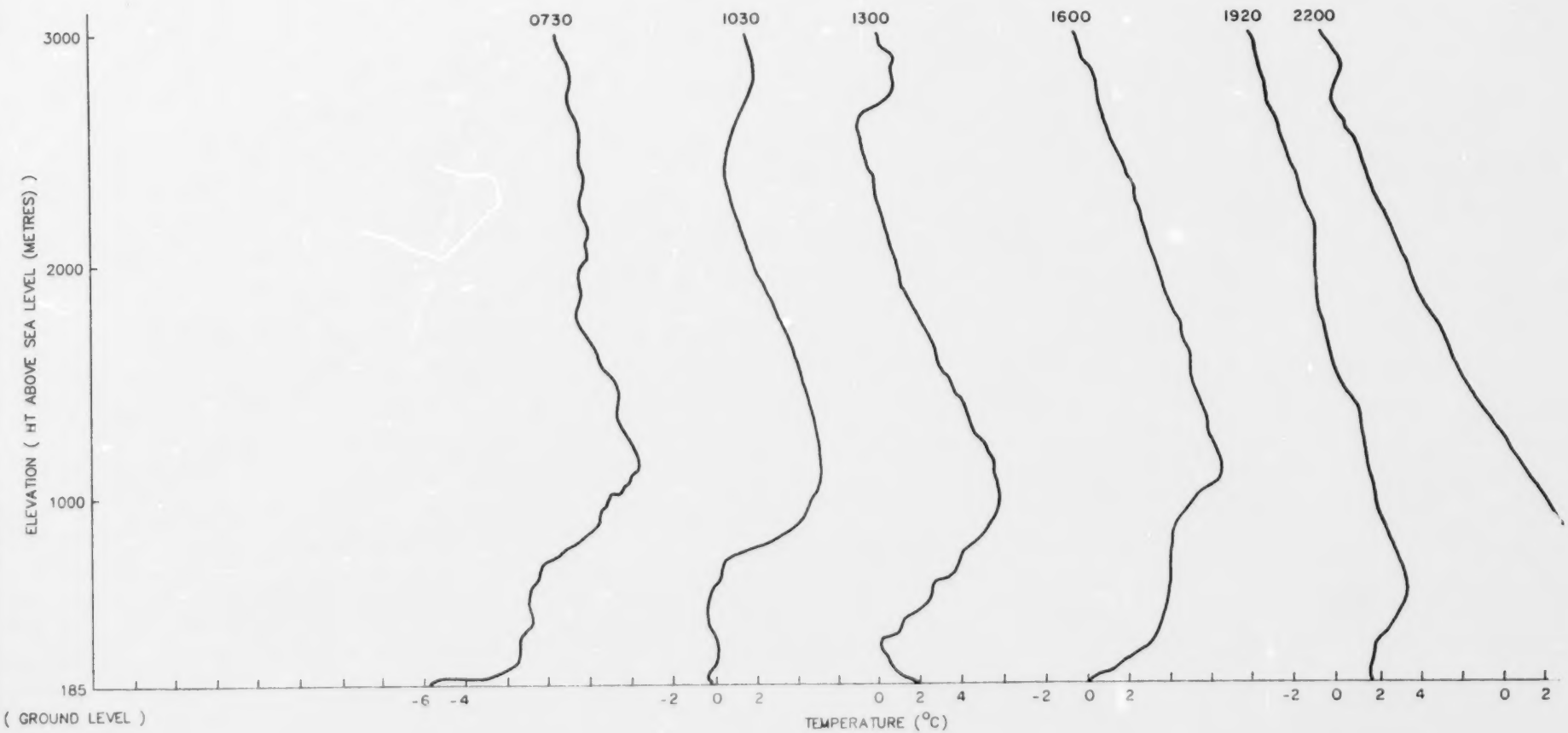


FIGURE 49 MINISONDE TEMPERATURE PROFILES DATE : JAN. 7, 1987

CONDITIONS : Mean Temp. 1.5°C, Precip. 0 mm, Mean Wind Spd. 17.0 km/hr, Prev. Wind Dir. WSW-WNW, Overcast

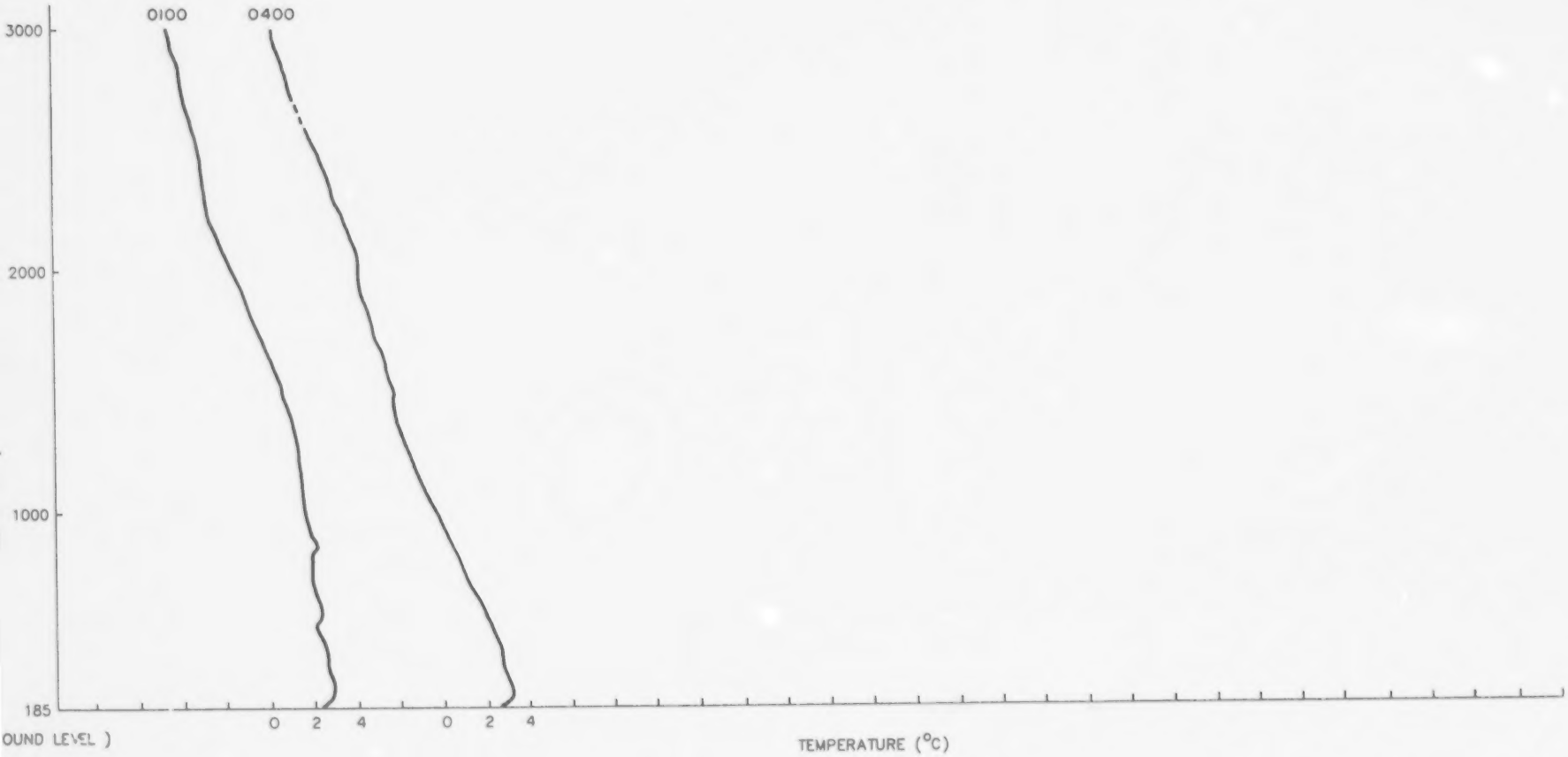


FIGURE 50 . MINISONDE TEMPERATURE PROFILES DATE : JAN. 9 , 1987

CONDITIONS : Mean Temp. 0.0°C , Precip. 0 mm, Mean Wind Spd. 10.1 km/hr, Prev. Wind Dir. WSW , Overcast

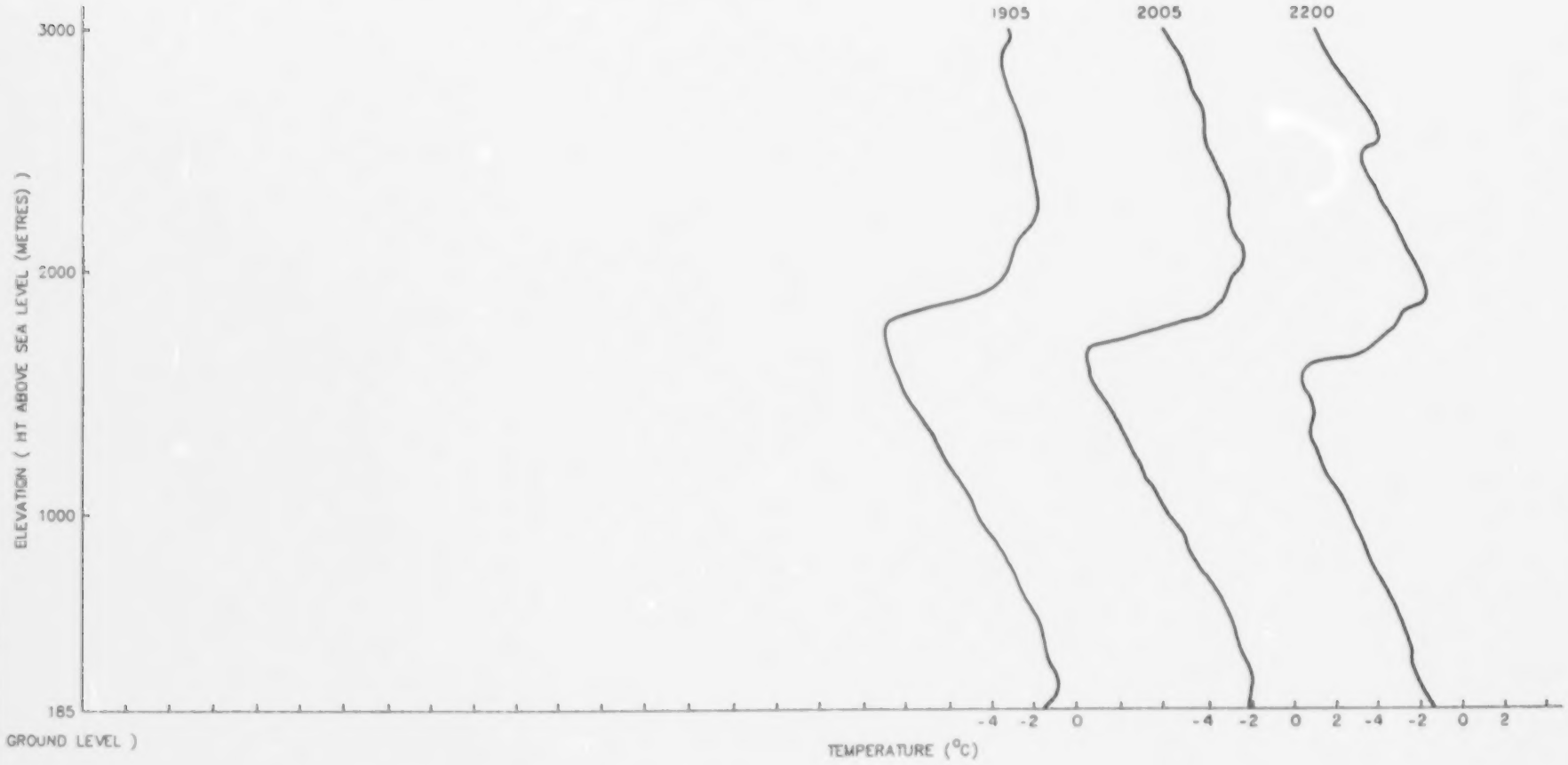


FIGURE 51 . MINISONDE TEMPERATURE PROFILES DATE : JAN. 10, 1987

CONDITIONS : Mean Temp. 0.6 °C, Precip. 1.25 mm, Mean Wind Spd. 7.9 km/hr, Prev. Wind Dir. Variable, Overcast

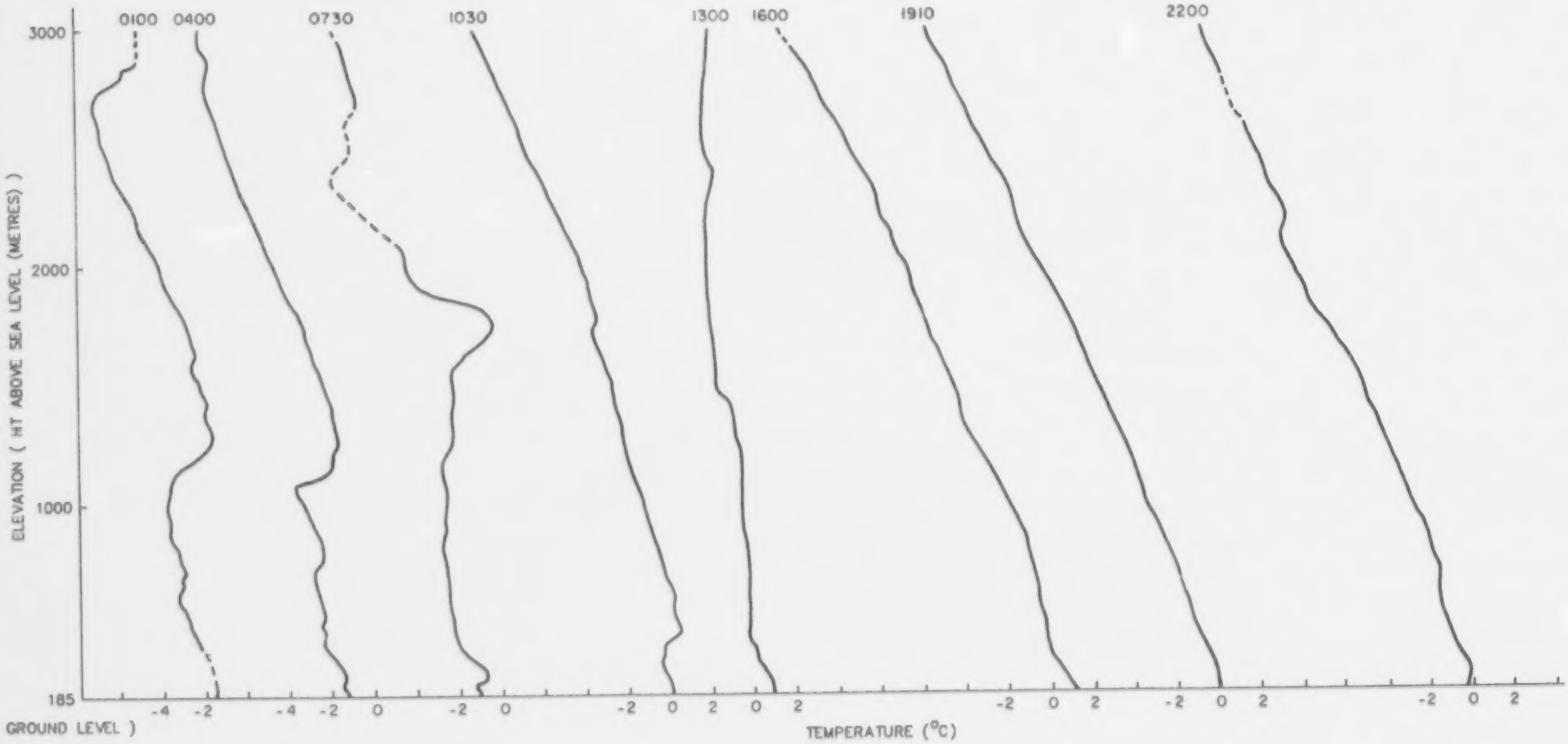


FIGURE 52 . MINISONDE TEMPERATURE PROFILES DATE : JAN. 11, 1987

CONDITIONS : Mean Temp. -0.3°C, Precip. 0 mm, Mean Wind Spd. 17.0 km/hr, Prev. Wind Dir. WNW-WSW, Partly Cloudy

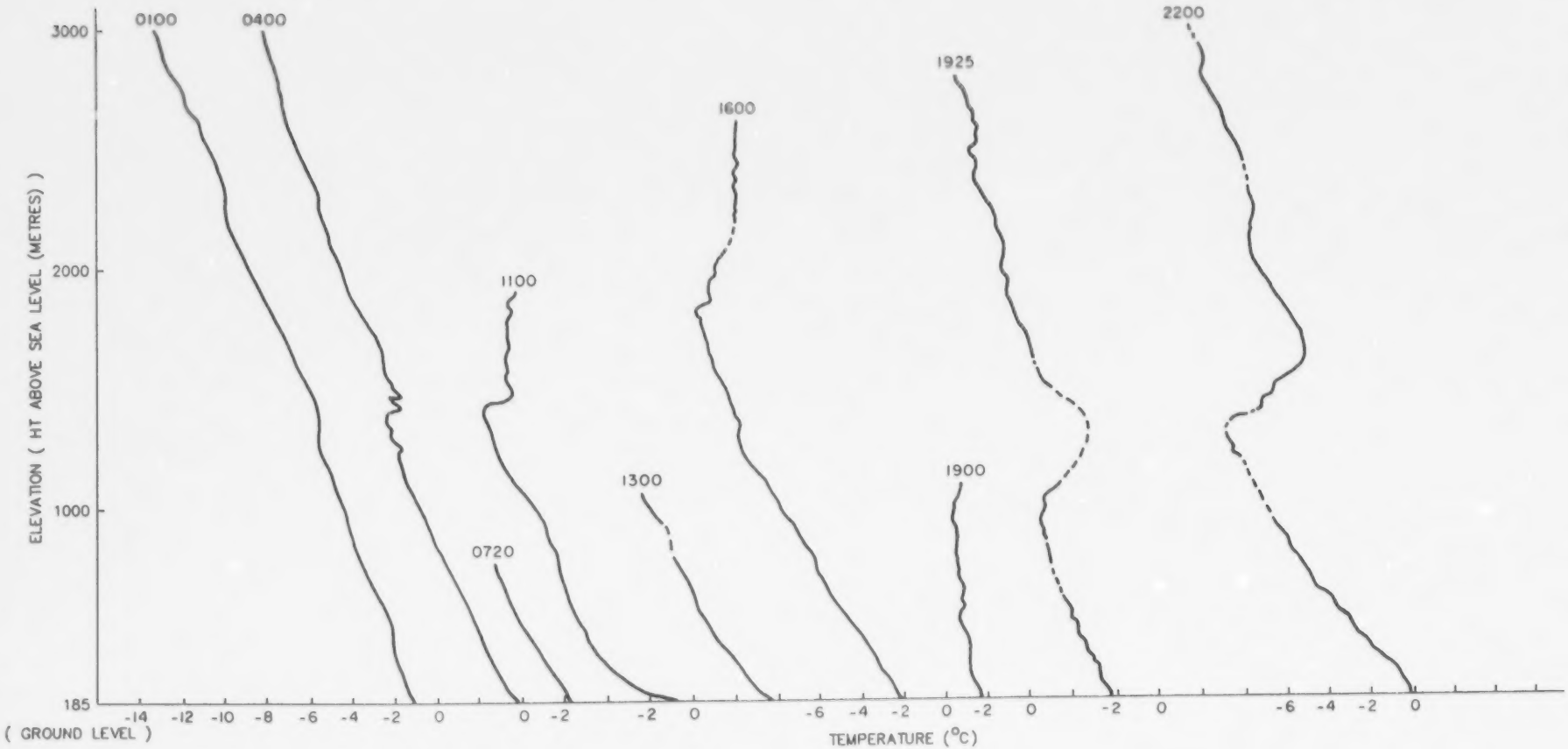


FIGURE 53 MINISONDE TEMPERATURE PROFILES DATE : JAN. 12 , 1987

CONDITIONS : Mean Temp. 0.6°C , Precip. 0 mm , Mean Wind Spd. 19.0 km/hr, Prev. Wind Dir. WSW-WNW, Overcast

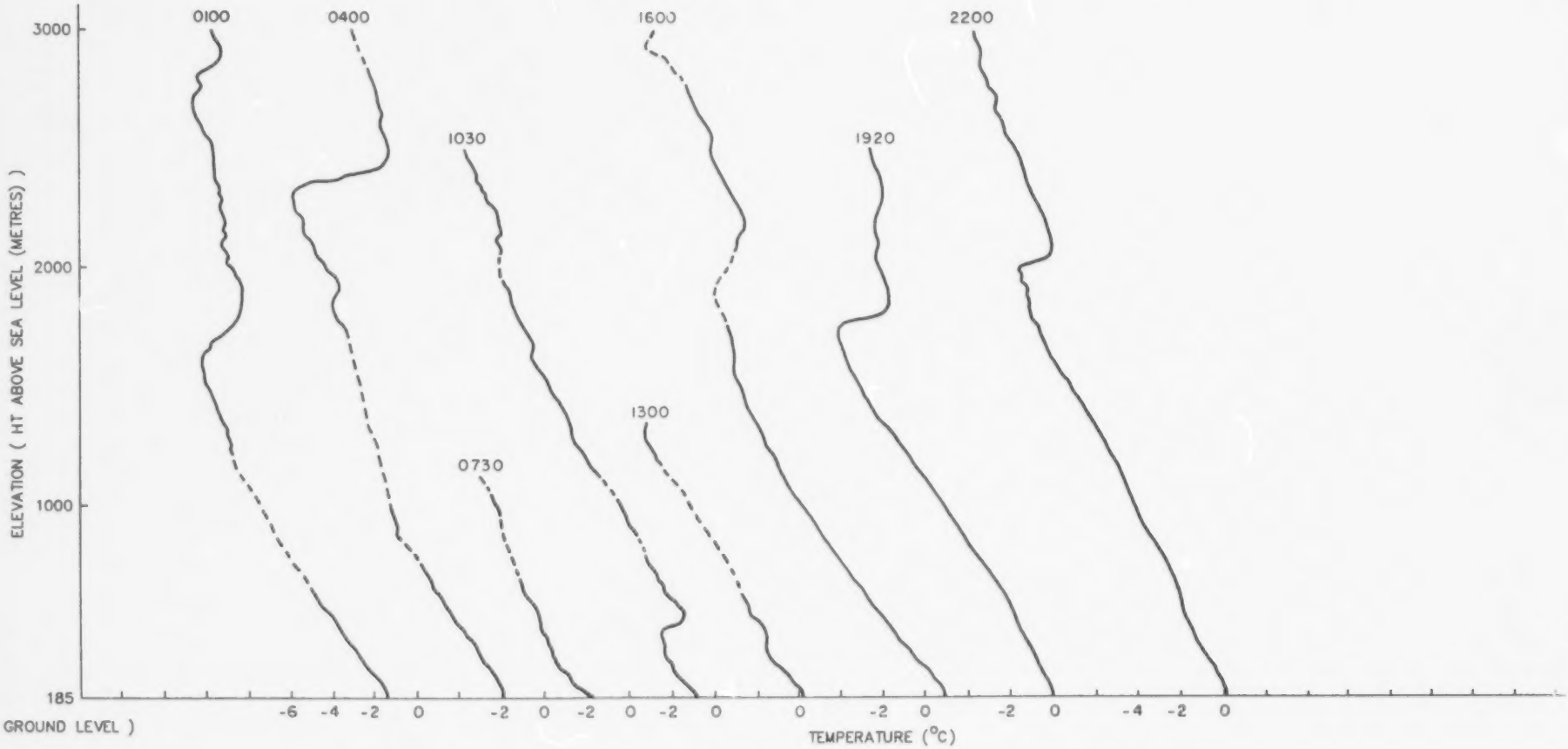


FIGURE 54 MINISONDE TEMPERATURE PROFILES DATE : JAN. 13, 1987

CONDITIONS : Mean Temp. 1.1°C, Precip. 0 mm, Mean Wind Spd. 11.3 km/hr, Prev. Wind Dir. WSW-WNW, Partly Cloudy

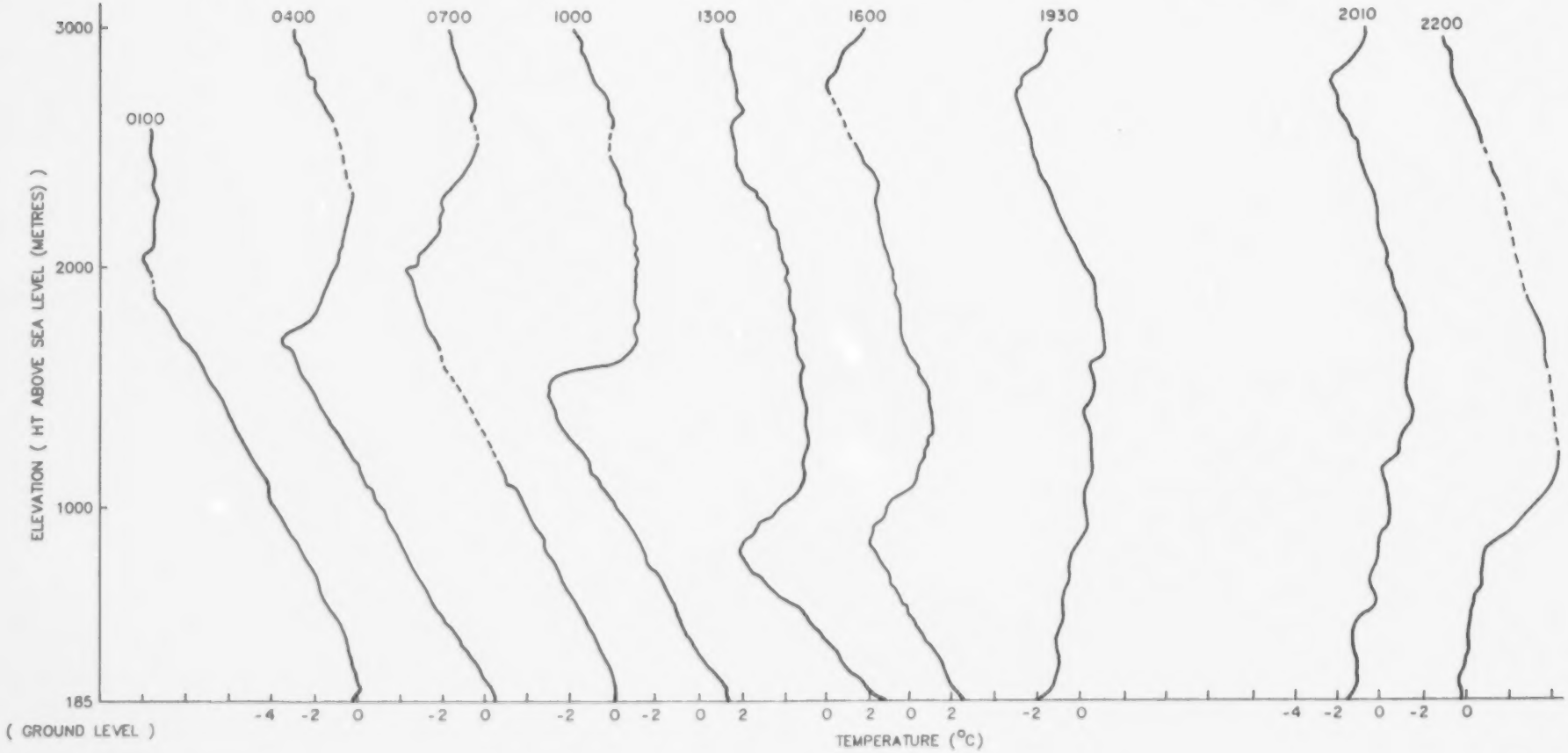


FIGURE 55 MINISONDE TEMPERATURE PROFILES DATE : JAN. 14, 1987

CONDITIONS : Mean Temp. 4.5°C, Precip.,25 mm, Mean Wind Spd. 18.7 km/hr, Prev. Wind Dir. SSW-WSW, Partly Cloudy

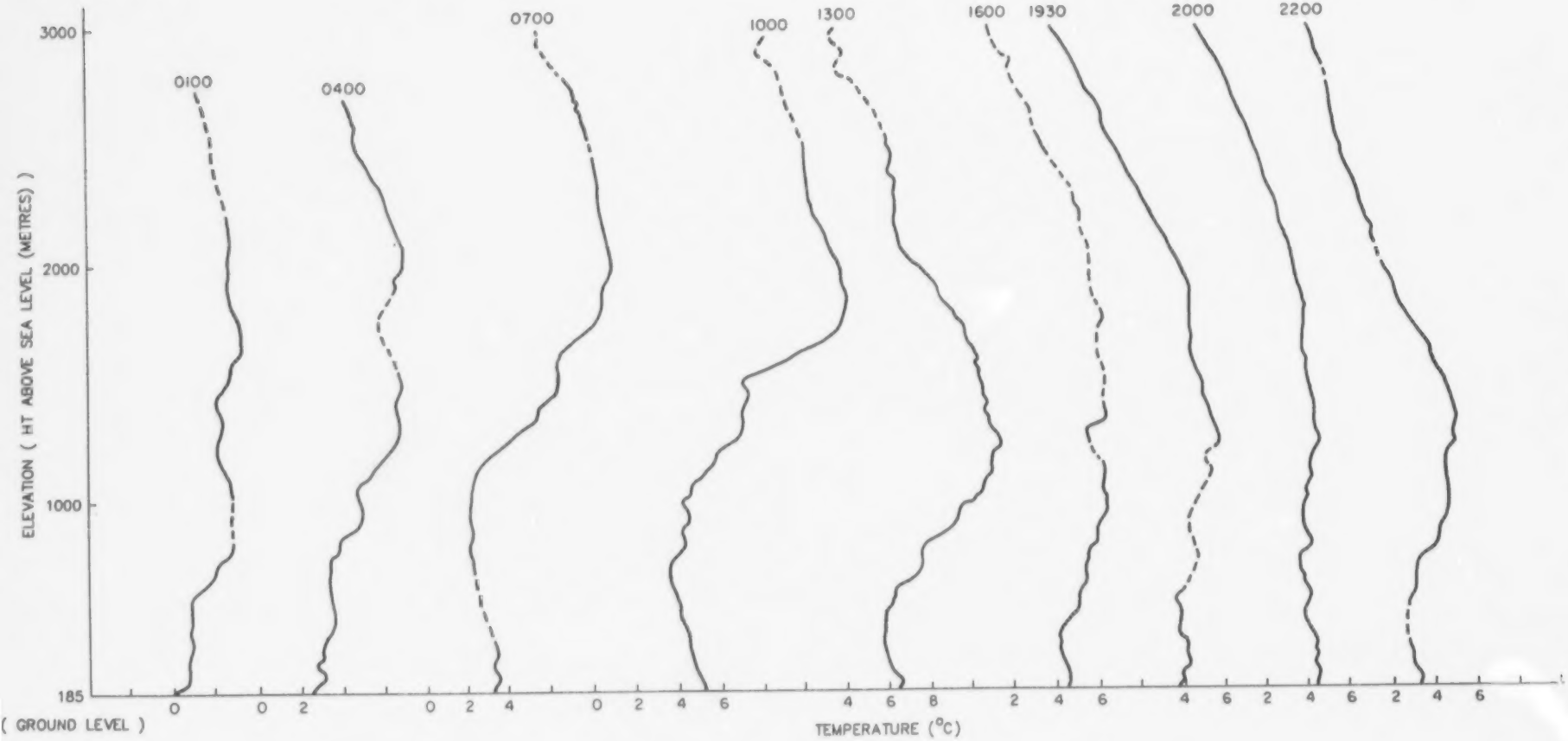


FIGURE 56 . MINISONDE TEMPERATURE PROFILES DATE : JAN. 15 , 1987

CONDITIONS : Mean Temp. 33° C , Precip. .50 mm , Mean Wind Spd. 15.7 km/hr , Prev. Wind Dir. SW-W-NW, Overcast

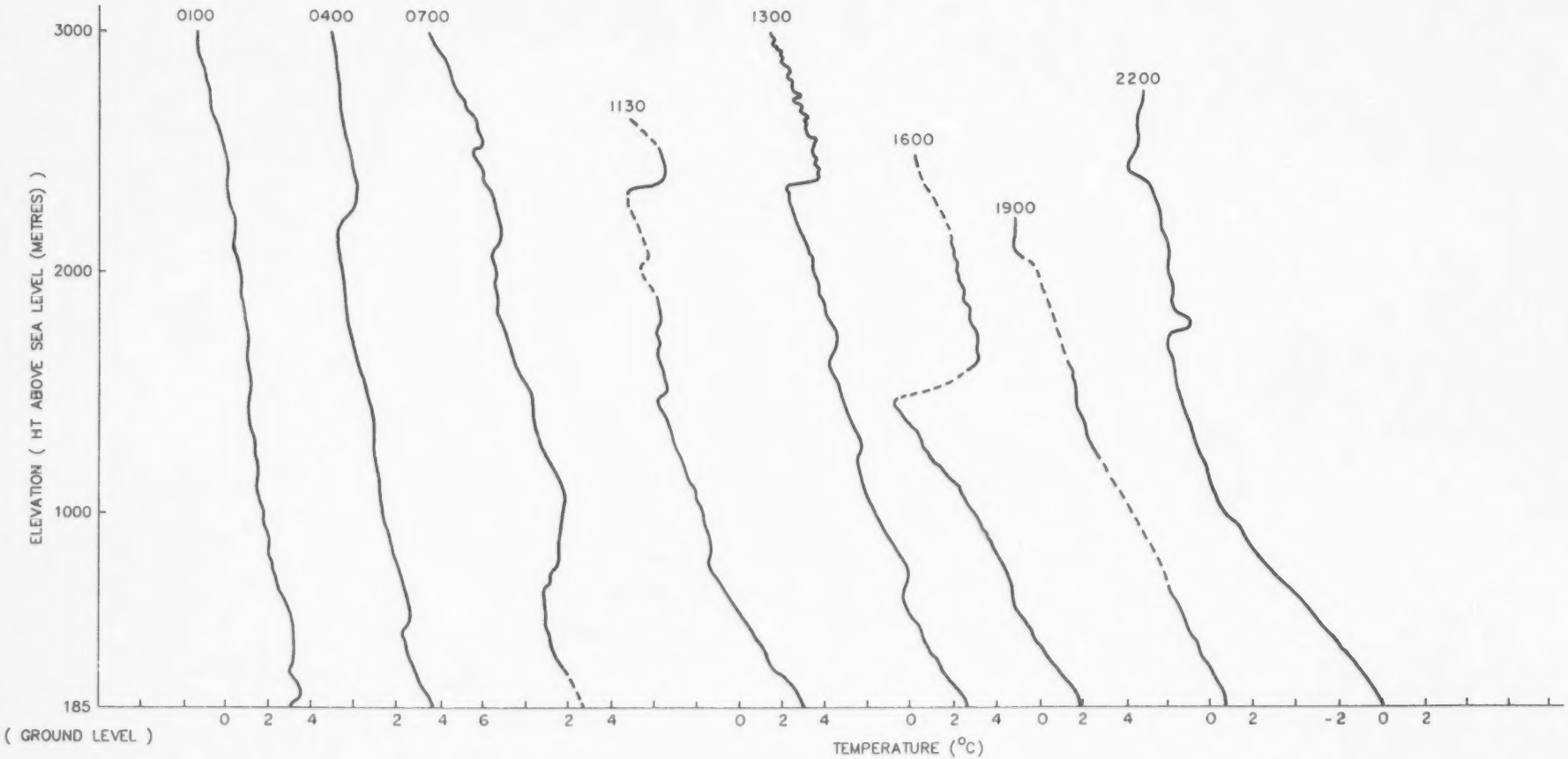


FIGURE 57 MINISONDE TEMPERATURE PROFILES DATE : JAN. 16, 1987

CONDITIONS : Mean Temp. -2.7°C, Precip. 0 mm, Mean Wind Spd. 7.6 km/hr, Prev. Wind Dir. NW-NE-E-NW, Partly Cloudy

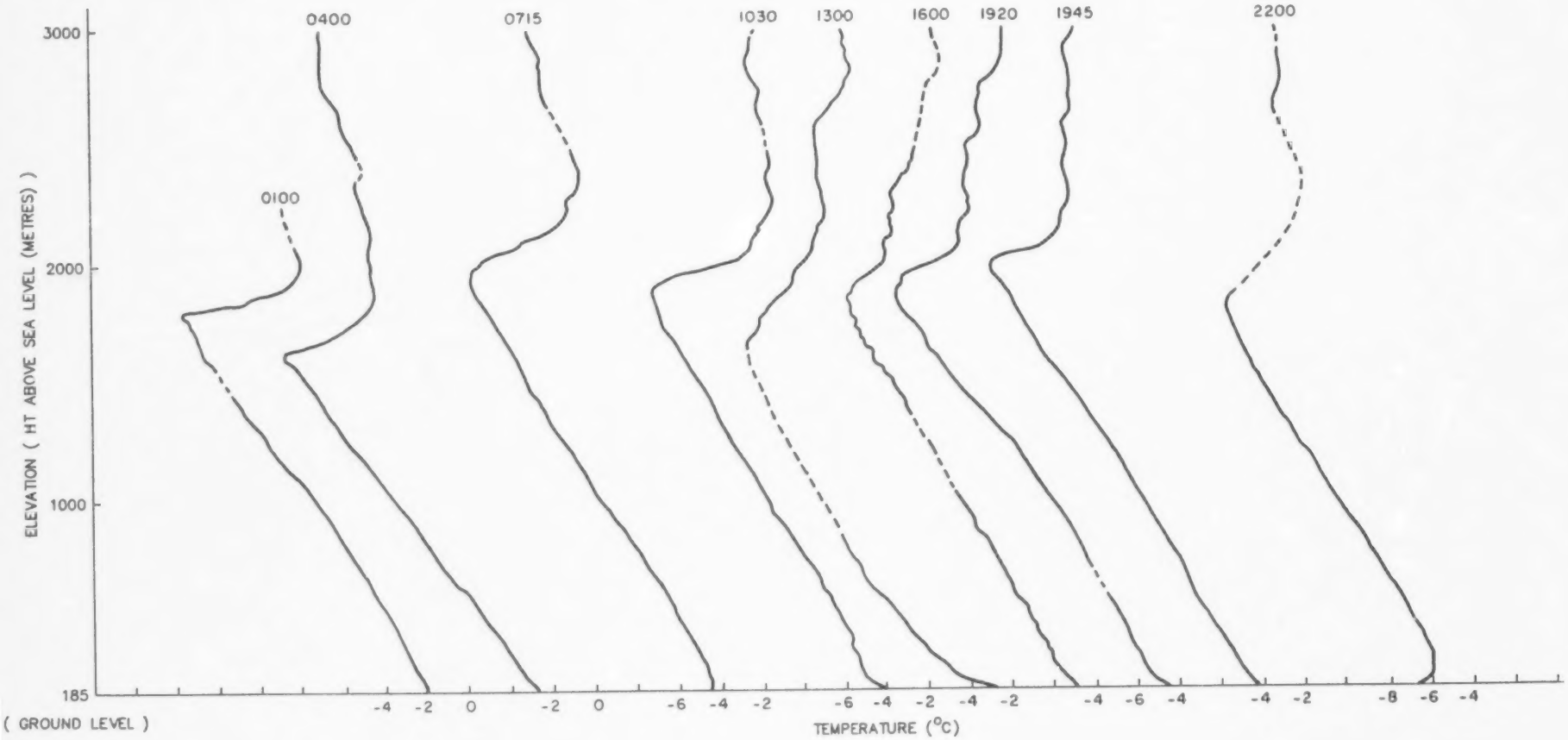


FIGURE 58 MINISONDE TEMPERATURE PROFILES DATE : JAN. 17 , 1987

CONDITIONS : Mean Temp. -3.9 °C , Precip. 0 mm , Mean Wind Spd. 10.8 km/hr , Prev. Wind Dir. N-E , Partly Cloudy

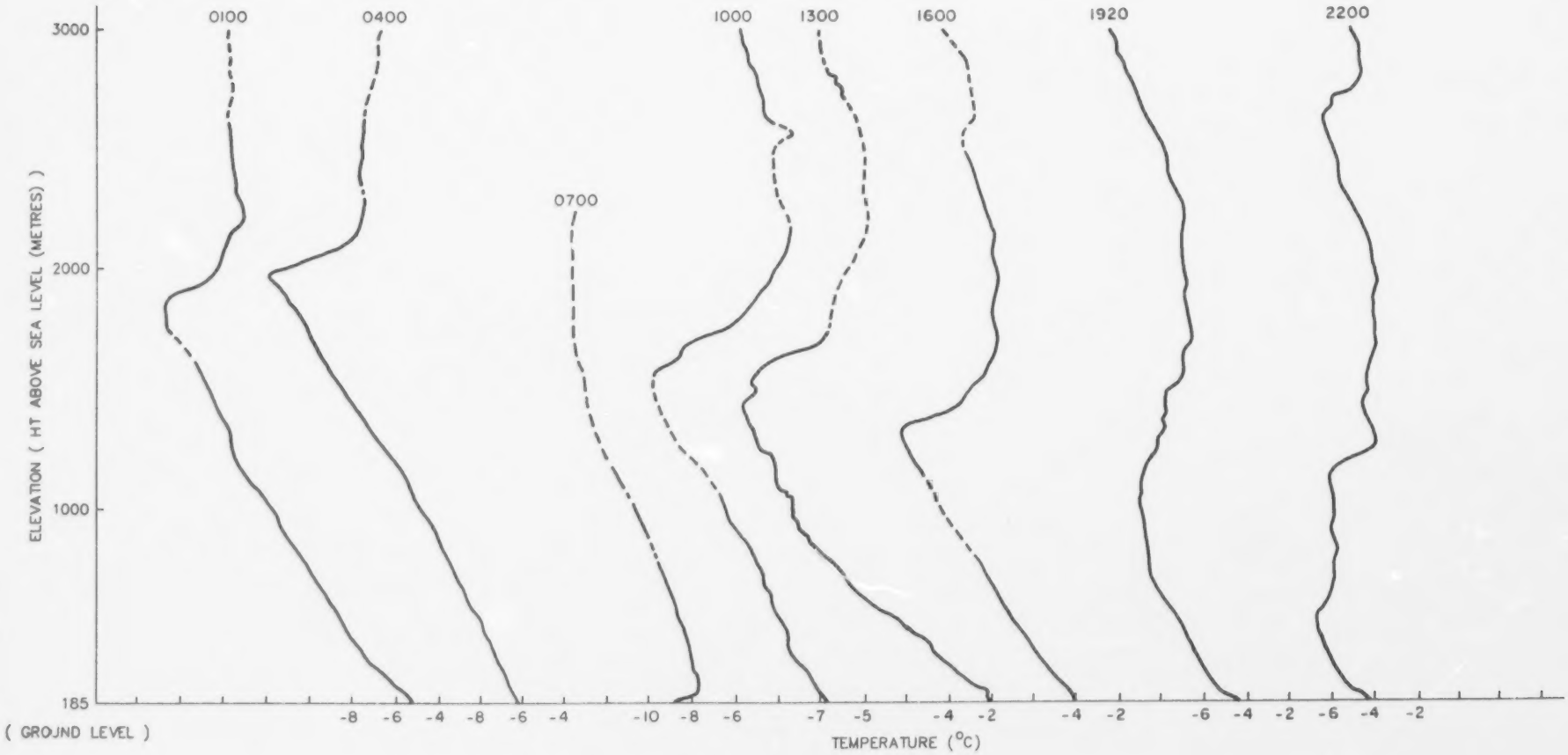


FIGURE 59 . MINISONDE TEMPERATURE PROFILES DATE : JAN. 18, 1987

CONDITIONS : Mean Temp. -0.6°C, Precip. 3.00 mm, Mean Wind Spd. 7.5 km/hr, Prev. Wind Dir. Variable, Overcast

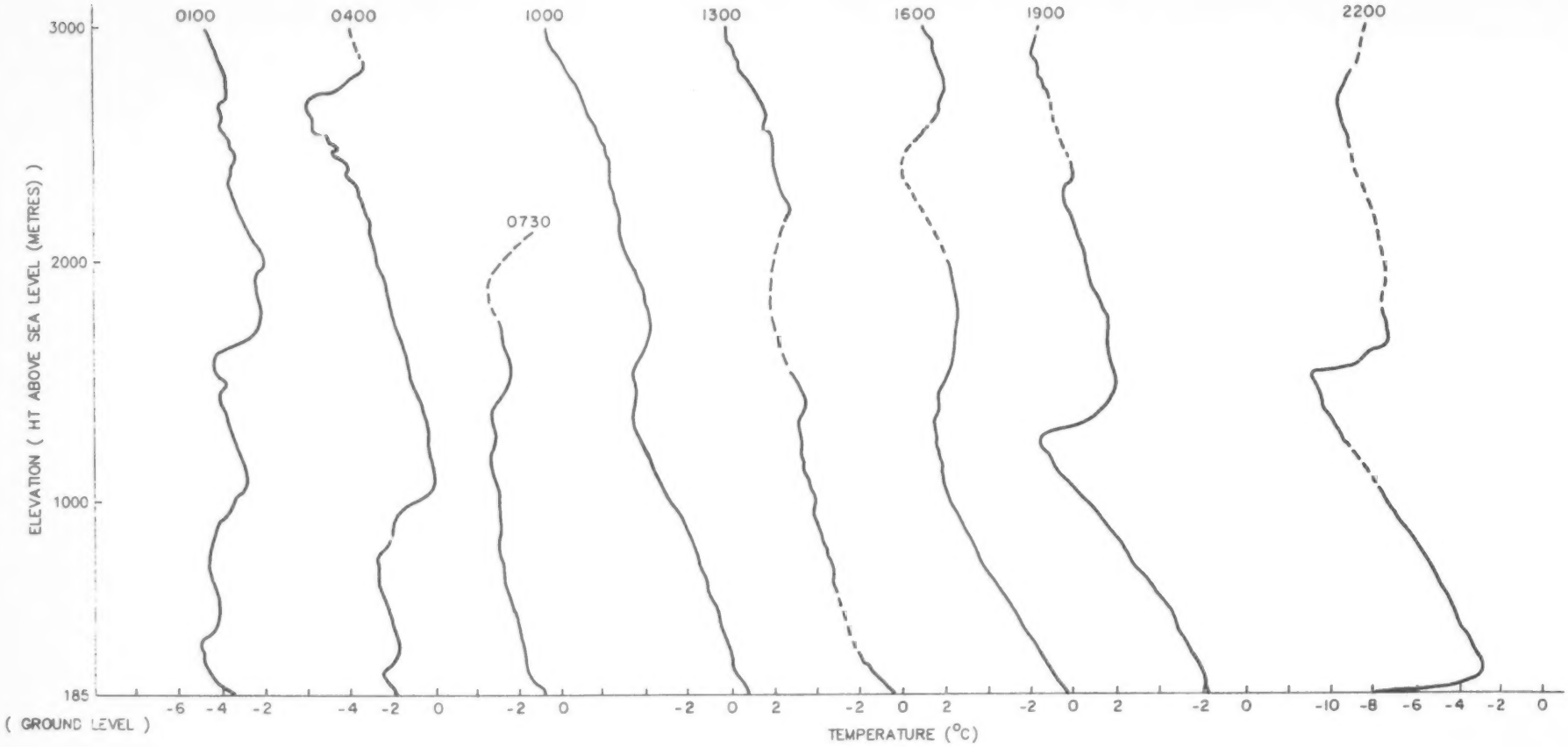


FIGURE 60 MINISONDE TEMPERATURE PROFILES DATE : JAN. 19 , 1987

CONDITIONS : Mean Temp. -3.1°C , Precip. 0 mm , Mean Wind Spd. 15.7 km/hr , Prev. Wind Dir. NE-ENE , Overcast

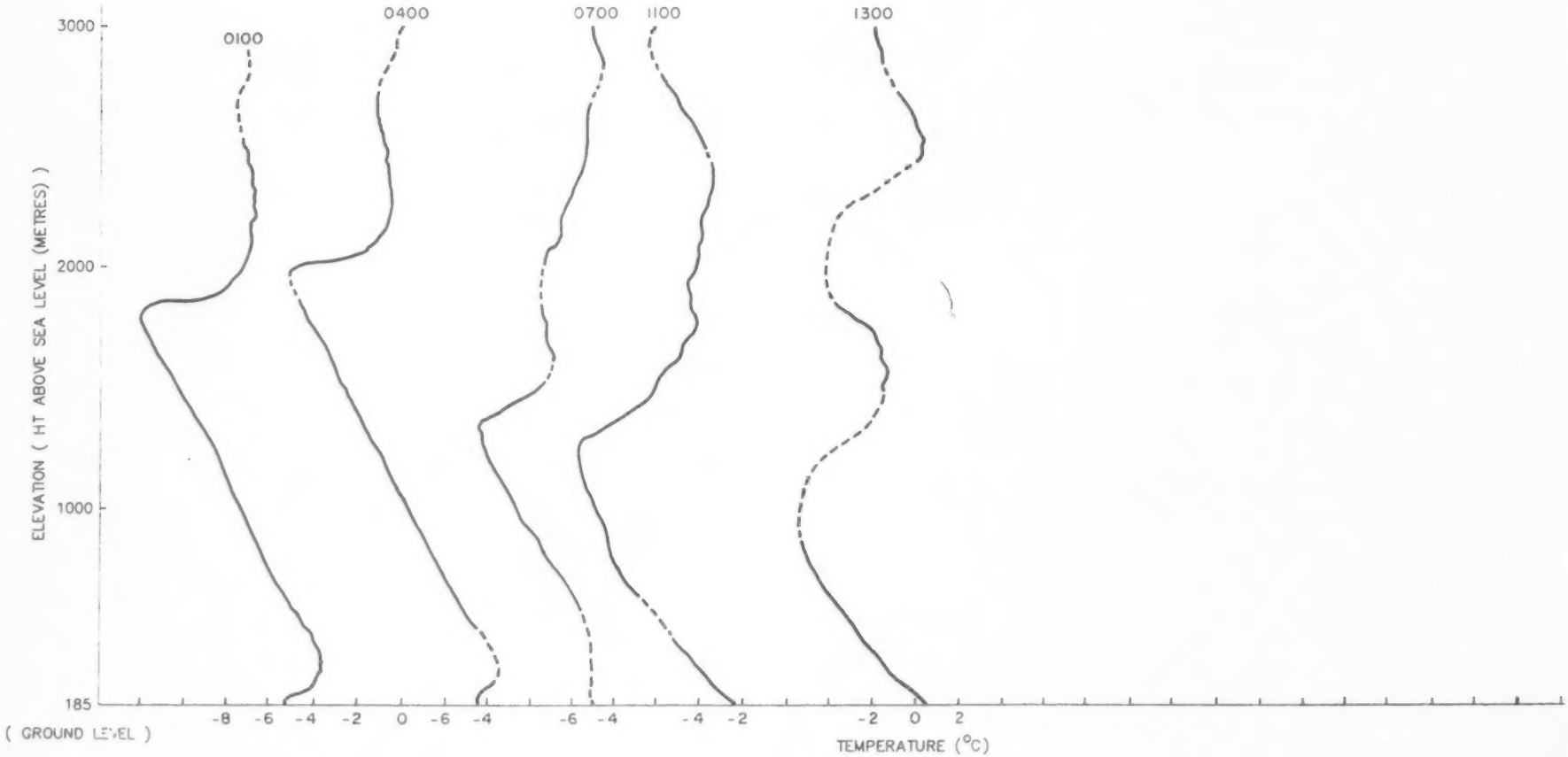
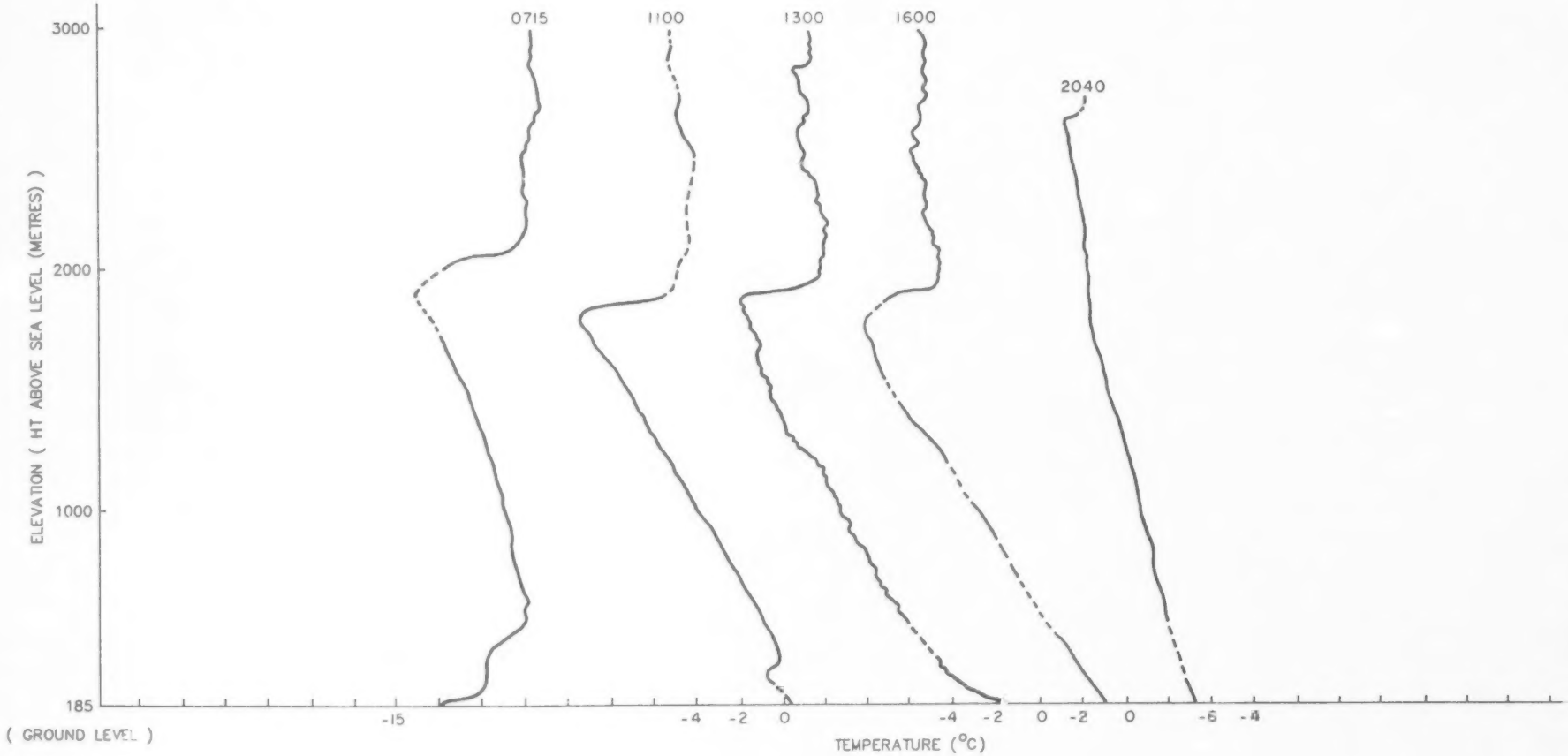


FIGURE 61 MINISONDE TEMPERATURE PROFILES DATE : JAN. 20 , 1987

CONDITIONS : Mean Temp. -4.9 , Precip. 0 mm , Mean Wind Spd. 10.8 km / hr, Prev. Wind Dir. SW-WSW, Partly Cloudy



APPENDIX F-2

Results of TAGA Surveys

AMBIENT AIR QUALITY STUDY
AT THE FUTURE LOCATION OF THE
ONTARIO WASTE MANAGEMENT SITE
IN WEST LINCOLN TOWNSHIP, ONTARIO

APRIL 12, 1986

JULY 10, 1986

OCTOBER 9, 1986

Prepared by:

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Bruce E. Dumdei

MDS Advanced Analytics, Inc.

Two Dundee Park

Andover, MA 01810

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1.0 INTRODUCTION

MDS Advanced Analytics, Inc. was contracted by the Ontario Research Foundation (ORF) to conduct air monitoring at and adjacent to the proposed site of the hazardous waste management facility in West Lincoln Township, Ontario. This monitoring was a part of an ongoing program by the ORF to provide a comprehensive air quality pre-operational baseline study for Ontario Waste Management Corporation (OWMC).

The air monitoring was performed using the TAGA 6000 with the Low Pressure Chemical Ionization (LPCI) source. Three surveys were conducted; Saturday, April 12, 1986, Thursday, July 10, 1986, and Thursday, October 9, 1986 as part of a multiphase program to help establish an air quality database for the different seasons. The analytical equipment was operated by David Mickunas, Project Manager, and Bruce Dumdei, Ph.D., Senior Scientist. Monika Dobson was the Ontario Research Foundation liaison.

The objectives of the TAGA portion of the program were:

- Qualitatively screen locations for ions of compounds cited in Table 1.
- Qualitatively screen locations for compounds observed but not cited in Table 1.
- Quantitate locations for eight (8) compounds, at least one from each class, cited in Table 2.

The following report represents the data collected during this program. A data appendix contained at the end of the text holds supporting calibration curves and confirming mass spectra.

TABLE 1-1

TARGETED COMPOUNDS

m/z	Name
54	Acrylonitrile $(M+H^+)$
59	Acetone $(M+H^+)$
62	Dimethylsulfide Vinyl Chloride $C_2H_3{}^{35}Cl$
64	Vinyl Chloride $C_2H_3{}^{37}Cl$
73	Methyl Ethyl Ketone $(M+H^+)$
75	Methyl Acetate $(M+H^+)$
76	Carbon Disulfide
77	Allyl Chloride $C_3H_5{}^{35}Cl$ $(M+H^+)$
78	Benzene
79	Allyl Chloride $C_3H_5{}^{37}Cl$ $(M+H^+)$ Pyridine
85	Hexane (M^+-H) Chloroform $CH^{35}Cl_2{}^{37}Cl$ $(M^+-{}^{35}Cl)$ Methylene Chloride $CH_2{}^{35}Cl_2$ $(M+H^+)$
87	Methyl Acrylate $(M+H^+)$ Methylene Chloride $CH_2{}^{35}Cl^{37}Cl$ $(M+H^+)$
88	Dioxane
89	Ethyl Acetate $(M+H^+)$ Dioxane $(M+H^+)$
92	Toluene
93	Bromomethane $CH_3{}^{79}Br$ (M^+-H) Dibromomethane $CH_2{}^{79}Br_2$ $(M^+-{}^{79}Br)$
94	Phenol Aniline $(M+H^+)$

(continued)

TABLE 1-1 (continued)

TARGETED COMPOUNDS

m/z	Name
95	Bromomethane $CH_3{}^{81}Br$ (M^+-H) Dibromomethane $CH_2{}^{79}Br^{81}Br$ (M^+-^{79}Br)
97	Dichloroethane $C_2H_4{}^{35}Cl_2$ (M^+-H) Dichloroethene $C_2H_2{}^{35}Cl_2$ ($M+H^+$) Methyl Chloroform $C_2H_3{}^{35}Cl_3$ (M^+-^{35}Cl)
99	Dichloroethane $C_2H_4{}^{35}Cl^{37}Cl$ (M^+-H) Dichloroethene $C_2H_2{}^{35}Cl^{37}Cl$ ($M+H^+$) Methyl Chloroform $CH^{35}Cl_2{}^{37}Cl$ (M^+-^{37}Cl) Heptane (M^+-H)
101	Methyl Isobutyl Ketone ($M+H^+$) Ethyl Acrylate ($M+H^+$)
105	Styrene ($M+H^+$)
106	Xylene
108	Cresol
112	Chlorobenzene $C_6H_5{}^{35}Cl$
113	Octane (M^+-H)
114	Chlorobenzene $C_6H_5{}^{37}Cl$
117	Butyl Acetate ($M+H^+$) Carbon Tetrachloride $C^{35}Cl_4$ (M^+-^{35}Cl) Chloroform $CH^{35}Cl_3$ (M^+-H)
119	Carbon Tetrachloride $C^{35}Cl_3{}^{37}Cl$ (M^+-^{35}Cl) Chloroform $CH^{35}Cl_2{}^{37}Cl$ (M^+-H)
120	Trimethyl Benzene
124	Nitrobenzene
128	Bromochloromethane $CH_2{}^{79}Br^{35}Cl$
131	Trichloroethane $C_2H_3{}^{35}Cl_3$ (M^+-H) Trichloroethene $C_2H^{35}Cl_3$ ($M+H^+$) Methyl Chloroform $C_2H_3{}^{35}Cl_3$ (M^+-H)

(continued)

TABLE 1-1 (Continued)

TARGETED COMPOUNDS

m/z	Name
133	Trichloroethane $C_2H_3{}^{35}Cl_2{}^{37}Cl$ (M^+-H)
	Trichloroethene $C_2H^{35}Cl_2{}^{37}Cl$ $(M+H^+)$
	Methyl Chloroform $C_2H_3{}^{35}Cl_2{}^{37}Cl$ (M^+-H)
	Toluene Isocyanate
146	Dichlorobenzene $C_6H_4{}^{35}Cl_2$
148	Dichlorobenzene $C_6H_4{}^{35}Cl^{37}Cl$
152	Carbon Tetrachloride $C^{35}Cl_4$
162	Bromodichloromethane $CH^{79}Br^{35}Cl_2$
164	Bromodichloromethane $CH^{81}Br^{35}Cl_2$
	Tetrachloroethene $C_2{}^{35}Cl_4$
166	Tetrachloroethene $C_2{}^{35}Cl_3{}^{37}Cl$
	Tetrachloroethane $C_2H_2{}^{35}Cl_4$
168	Tetrachloroethane $C_2H_2{}^{35}Cl_3{}^{37}Cl$
171	Dibromochloromethane $CH^{79}Br_2{}^{35}Cl$ $(M^+-{}^{35}Cl)$
	Bromoform $CH^{79}Br_3$ $(M^+-{}^{79}Br)$
172	Dibromomethane $CH_2{}^{79}Br_2$
174	Dibromomethane $CH_2{}^{79}Br^{81}Br$
206	Dibromochloromethane $CH^{79}Br_2{}^{35}Cl$
249	Bromoform $CH^{79}Br_3(M^+-H)$

TABLE 1-2

CALIBRATION COMPOUNDS

Aromatics	Halogenated Hydrocarbons
• Benzene	• Chloroform
• Toluene	• Chlorobenzene
Xylene	Dibromoethane
Styrene	
Hydrocarbons	**Acrylates**
Hexane	• Methyl Acrylate
• Heptane	Ethyl Acrylate
Octane	Butyl Acrylate
Ketones	**Acetates**
Acetone	Ethyl Acetate
• Methyl Ethyl Ketone	• Butyl Acetate
Methyl Isobutyl Ketone	Vinyl Acetate

• Denotes Compound Selected for Quantitation

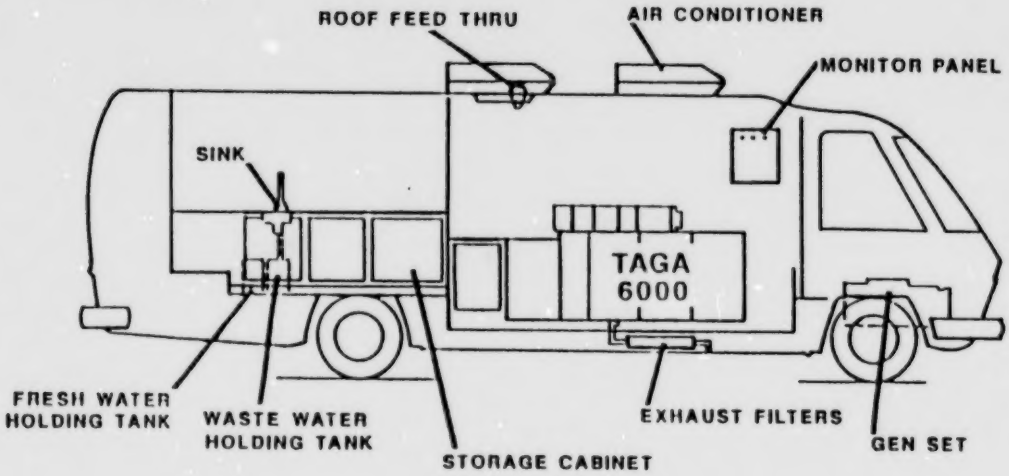
2.0 INSTRUMENTATION

All analyses were performed using a TAGA® 6000 triple stage mass spectrometer. The TAGA® 6000 was mounted in a 32-foot self-propelled van and allowed for on-site analysis in either the stationary or mobile mode (Figure 2-1). The van was equipped with external air sampling ports as well as internal sample preparation facilities to accommodate analytical requirements.

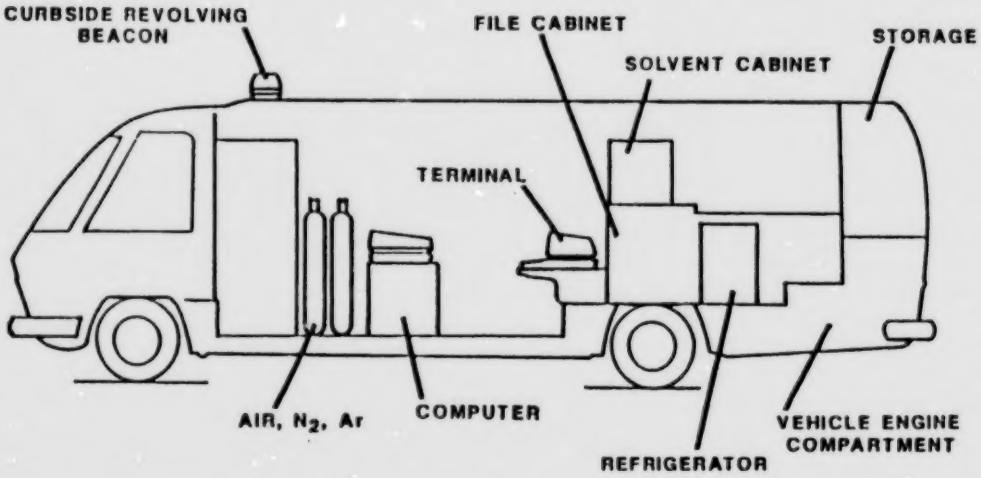
The TAGA® 6000 is a triple stage quadrupole mass spectrometer which can be operated either as a conventional mass spectrometer to produce simple mass spectra or as a triple stage quadrupole mass spectrometer to produce collisionally activated dissociation (CAD) spectra. The former operating mode provides the masses of molecular or parent ions present in samples whereas the latter operating mode provides positive identification of compounds.

Two ionization sources can be used with the MS/MS system; an Atmospheric Pressure Chemical Ionization (APCI) source which is more sensitive to compounds with high proton affinity such as acids and amines, or a Low Pressure Chemical Ionization (LPCI) source which is more sensitive to a broader group of compounds including aromatics and chlorinated compounds (Figure 2-2). The sources differ in their operating pressure and method of ionization.

In APCI, the ionization process is initiated by electrons created in a corona discharge. These high energy electrons then remove electrons from N_2 to form N_2^+. This ionization begins a sequence of reactions which eventually results in a population of reagent ions with the formula $H_3O^+(H_2O)_n$. These reagent ions then protonate the trace molecules present to form parent ions. In LPCI, the initial ionization is the result of



STREETSIDE ELEVATION



CURBSIDE ELEVATION

Figure 2-1. Diagram of Van Layout

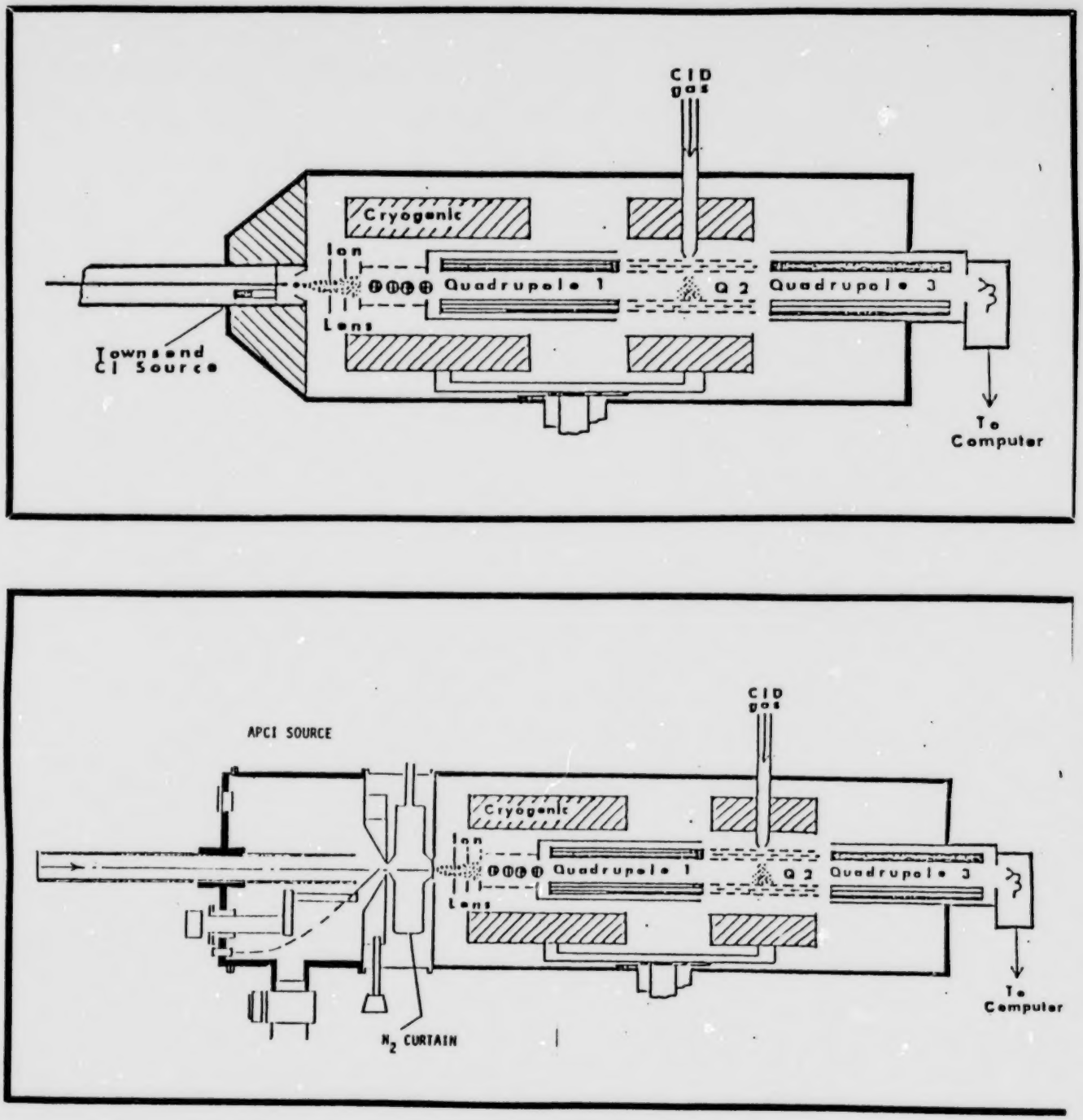


Figure 2-2. Diagram of LPCI Source (Top) and APCI Source (Bottom)

electron emission from a Townsend discharge. The reagent ions formed are $N2^+$, O_2^+, NO^+, and $H_3O^+(H_2O)_n$. The resulting ionization of trace components is the result of (1) charge exchange by NO^+ or N_2^+, (2) protonation by $H_3O^+(H_2O)_n$ or (3) NO^+ cluster formation.

The mass fragmentation and identification region consists of three sets of quadrupole rods. The first and third set of rods (Q1 and Q3) are identical and can operate either as high pass filters by placing only RF potential on them or they can be used for mass separation by placing RF and DC potentials on them. The middle set of rods (Q2) can only act as a high pass filter and serves as a collision chamber. CAD analysis is based on initial ionization of the compound to produce a parent ion, followed by collisionally activated dissociation of this ion to produce fragments or daughter ions. To obtain a daughter ion spectrum, the first set of rods is set to transmit only the parent ion into Q2. A stream of neutral (Ar) atoms is directed perpendicularly through Q2 colliding with the parent ions which then fragment to form daughter ions. Q3 is then scanned over the entire mass range to produce a daughter ion spectrum. Once the daughter ions have been determined, Q3 can be set to transmit only these ions to the multiplier. Quantitation is then accomplished by comparing the ion intensities for the daughter ions obtained from the samples to the intensities obtained for known concentrations.

3.0 PROCEDURE

Direct-air sampling was employed exclusively throughout this study. Direct-air sampling for the Low Pressure Chemical Ionization (LPCI) source allowed outside air to be drawn through a port in the roof of the van at an approximate flow rate of 2 liters per second. This flow rate, due to the high velocity, minimized adsorption effects of the tubing. The sample then passed over a glass splitter where a representative sample entered the transfer line leading to the LPCI source. The flow through the sampling line was drawn through the air motor and exhausted outside of the van (Figure 3-1).

Samples were first analyzed in the RF only mode which allowed only molecular or parent ions to be monitored. The data from the baseline sample (RF only mode scan obtained from zero-air gas cylinder) was qualitatively and quantitatively subtracted from that of each sample indicating only those components unique to the sample or present at higher concentrations than that found in the baseline sample.

Once the ions of interest were determined, the samples were reanalyzed using the full MS/MS capabilities to generate fragmentation or daughter ion scans for each of these ions. This characteristic fragmentation pattern or mass spectrum was then computer searched against the library of spectra on the computer. The computer search, as well as technical review, was used to characterize the samples.

Time-weighted averages (TWA) for targeted calibration compounds of various chemical classes were conducted. The signal intensity, averaged over the sampling period, was then compared to a standard of that compound to determine

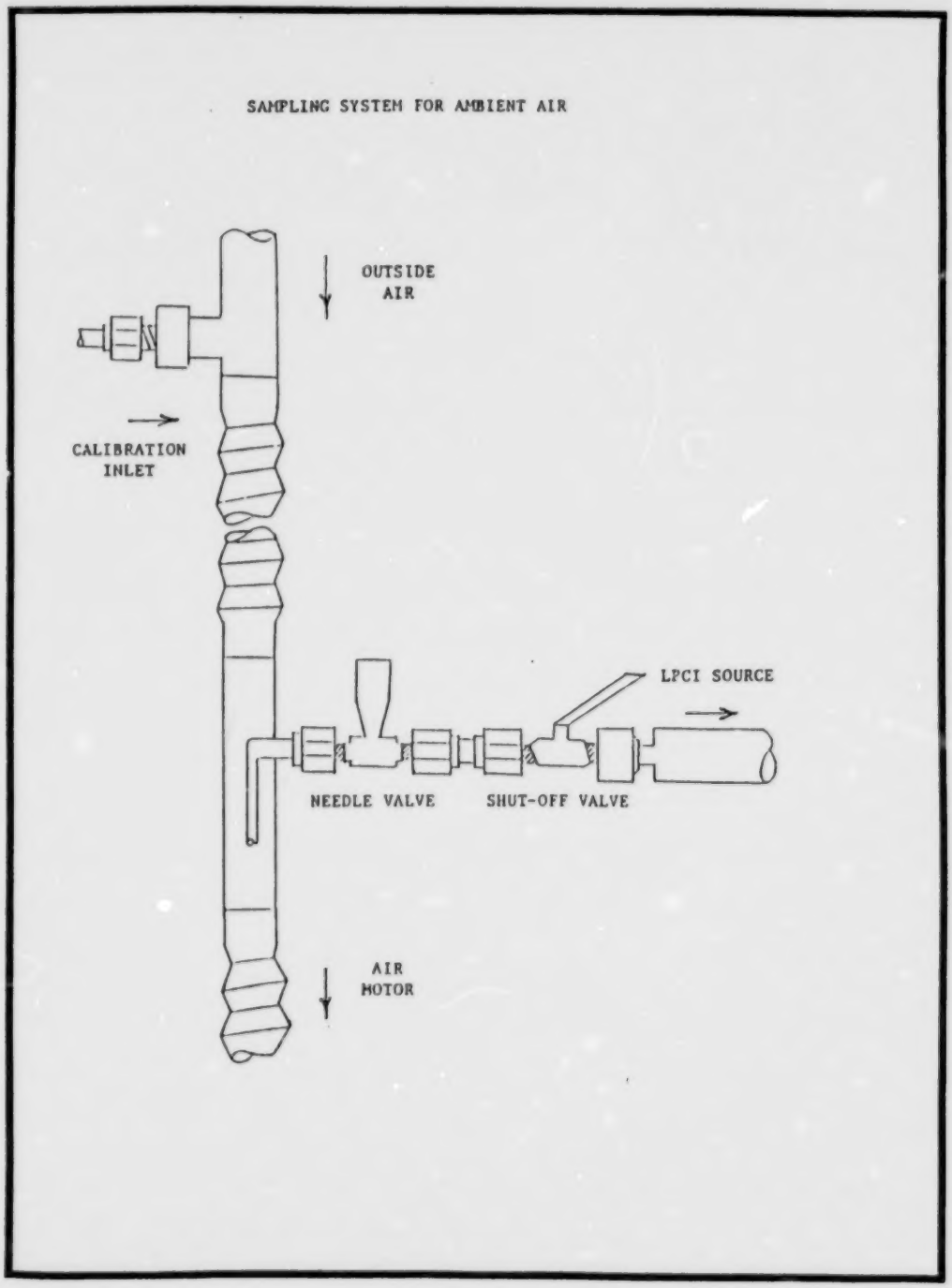


Figure 3-1. LPCI Sample Inlet

concentration. Quantitation was performed by monitoring two daughter ions for each compound. Two daughter ions were monitored to add confidence to the identification of each compound and to provide quantitative information even in the case of one ion being masked by an interferent.

4.0 QUALITY CONTROL PROGRAM

The following is a summary of the multi-step Quality Control Program implemented by MDS Advanced Analytics.

4.1 Mass Calibration

To assure that the assignment of the mass-to-charge ratio (m/z) is correct, the instrument is set up to scan within a 4 amu range of a nominal mass value for a compound. The compounds for mass calibration are acetone (m/z=59), nitrobenzene (m/z=124) and tetrachloroethene (m/z=164). It is very important that the ions produced in the source be measured with sufficient accuracy to give the correct mass assignment in each scanning quadrupole. The criteria requires an absolute accuracy of ± 0.2 amu.

Once the mass-to-charge ratios are at their nominal value in each scanning quadrupole, the computer stores this information for use during acquisition. This calibration is performed at the begining of each day's work.

4.2 Compound Calibration

The stability of the instrument is checked daily by a compound calibration check. This check is performed prior to any quantitative analysis and in addition to any formal compound calibration done for target compounds.

Calibration of the TAGA® response versus concentration of organic compounds is done using injections of vapors at a known rate into the ambient air flow using a syringe drive apparatus. The syringe drive apparatus holds a glass syringe coated with the compound being calibrated. After vapor equilibrium is established, the syringe drive introduces the vapors into the air stream at a known rate.

The concentrations are calculated by the computer utilizing the following formula:

$$C\ (ppb) = \frac{P_s \times I \times 10^9}{P_a \times F}$$

where: C = Concentration in ppb of the trace component in the air stream

P_s = Saturation vapor pressure of the compound at the syringe temperature (Torr)

P_a = Atmospheric pressure (760 Torr)

I = Injection rate (ml/sec)

F = Air stream flow rate (ml/sec)

A graph of the instrument response versus concentration constitutes the calibration curve of the compound.

In the event that a standard is not available for a compound identified, a similar compound from the same chemical class is used and the concentration for that compound is estimated.

4.3 Instrument Sensivity Check

As part of both the mass and compound calibration checks, a sensitivity check is also conducted. This requires a comparison of ion counts for compounds observed during mass calibration and those values from historical data. Deviations less than 15-20% in these values indicates no change in the operating status of the instrument. Deviation greater than 20% requires recalibration of the system.

4.4 Technical Review

All data is subjected to a qualitative identification via the computer library search as well as review and evaluation by an experienced mass spectroscopist.

4.5 Interferences

When using the TAGA® MS or MS/MS systems, there are certain limitations in alleviating interferences. There are four basic types of interferences.

First, the instrument cannot distinguish structural isomers from one another. For example, the TAGA® even in the MS/MS mode cannot distinguish between xylene and ethyl benzene due to their similar fragmentation patterns. In this case, both compounds are reported and a response factor for one of the compounds is used for quantitation purposes.

In addressing questions on why the TAGA® cannot distinguish between certain compounds such as vinylidene chloride and methyl chloroform (which are not structural isomers), SCIEX® (the manufacturer of the analytical instrumentation) has proposed that parent ion fragmentation can occur for some species in the LPCI source due to the ionization conditions. This situation mainly occurs in chlorinated hydrocarbons. The soft ionization that occurs in the source itself is strong enough for some chlorinated compounds to lose a chlorine atom forming the parent $(M-Cl)^+$ ion (M minus Cl).

Vinylidene chloride has molecular weight of 96 and the parent ion formed is the $(MH)^+$ ion at m/z 97. Methyl chloroform has a molecular weight of 132, but the parent ion formed is not the $(MH)^+$ but the $(M-Cl)^+$ ion thus the parent ion formed is (132-35) or m/z 97.

Ions Observed	Compound	Molecular Weight (AMU)
97 (MH^+)	Vinylidene Chloride	96
97 $(M-Cl)^+$	Methyl Chloroform	132

After methyl chloroform loses Cl, the ionized species is identical to the charged vinylidene chloride ion $(CH_2\text{-}CCl_2)^+$. The fragmentation pattern is identical and thus indistinguishable by mass spectroscopy without special reagent gas mixtures and parameters settings.

Thirdly, with certain compounds (e.g., methyl ethyl ketone; m/z 73) known interferences from high levels of water and clusters of water can affect qualitative as well as quantitative determination of compounds with mass-to-charge ratios equal to that of the water clusters. Whenever possible parent and fragment ions are chosen to avoid such interferences.

There is also the possibility of interferences from the TAGA® drive engine/generator exhaust. Although the system is designed to sample upwind of exhausts and minimize interferences, there are times when still wind conditions, fluctuating wind direction and mobile monitoring situations may contribute certain interferences at varying levels.

4.6 Detection Limits

The detection limits are defined as 3 standard deviations of the signal obtained while monitoring in zero air or at a point upwind where target compounds are not expected to be present. This level of signal corresponds to the response required to raise the signal significantly above electronic

noise. The 3 standard deviations rule is used to give an indication as to the lowest level of signal that can be quantitated with a less than significant contribution from electronic noise. The detection limit value stated, therefore, is not the lowest detectable signal but should be interpreted as the lowest level that can be quantitated accurately.

The detection limit value for each compound may not be the same from project to project or location to location due to the varying complexity of the matrices involved. Even while monitoring in a given matrix the background noise levels may vary due to the dynamic nature of that specific matrix (e.g., wind variation, traffic variation). Therefore, at times during the monitoring background noise levels may decrease enough to permit a mass spectrum to be obtained which is interpretable above the background noise levels. In this case the most significant ions may be present at approximately the correct ratios but a significant contribution from background noise can still be observed. This would allow for a qualitative identification only and not permit accurate quantitation of signal. The degree to which the background noise may vary, due to vapor pressure, ionization potential, and electronic interferences, is not determinable so an absolute lowest detectable level for a compound cannot be given.

5.0 RESULTS AND DISCUSSION

Tables 5-1, 5-2 and 5-3 list the results of the qualitative screens for the targeted compounds selected, as well as other compounds observed. Tables 5-4, 5-5 and 5-6 and Tables 5-7, 5-8 and 5-9 represent the time-weighted averages conducted at the meteorological station on site and a location approximately 50 meters from Highway 20 along Shram Road downwind of the site, respectively. Times shown in Tables 5-4 to 5-9 denote period of time that the time-weighted averages were acquired and for what compounds. All results reflect the findings acquired on 12 April, 1986, 10 July, 1986 and 9 October, 1986.

During the April survey, the predominant compounds observed were from the alkane, alkene, aromatic, and ketone classes. The aromatics noted were benzene and toluene at 4 ppb and 5 ppb, respectively. Higher levels for compounds were shown to exist at the Shram Road location compared with the meteorological site.

During the July study, the predominant compounds observed were from the hydrocarbon and ketone classes. These results are similar to the findings from the study conducted on 12 April, 1986 with the exception that toluene and benzene were not observed during the later study. A possible reason for this conclusion is the detection limits for benzene and toluene were at or above the levels detected on the previous study.

The results of the October survey indicate none of the target compounds were observed nor were any other compounds identified. There may have been several contributing factors responsible for the low concentrations:

(1) recent numerous and heavy rainfalls have resulted in providing a stripping action for the volatile organic compounds,

(2) lower ambient temperature on the day of monitoring reduced the volatile organic compounds' vapor pressure, and

(3) high wind speed caused better dispersion of the volatile organic compounds.

TABLE 5-1 - 12 April 1986

RESULT SUMMARY OF QUALITATIVE SITE CHARACTERIZATION

Target Compound	Meteorological Station	Site Downwind Along Shram Rd
Acetone	Q.I.	Q.I.
Acrylonitrile	N.D.	N.D.
Allyl Chloride	N.D.	N.D.
Aniline	N.D.	N.D.
Benzene	N.D.	Q.I.
Bromochloromethane	N.D.	N.D.
Bromomethane	N.D.	N.D.
Bromodichloromethane	N.D.	N.D.
Bromoform	N.D.	N.D.
Butyl Acetate	N.D.	N.D.
Carbon Disulfide	N.D.	N.D.
Carbon Tetrachloride	N.D.	N.D.
Chlorobenzene	N.D.	N.D.
Chloroform	N.D.	N.D.
Cresol	N.D.	N.D.
Dibromomethane	N.D.	N.D.
Dibromochloromethane	N.D.	N.D.
Dichlorobenzene	N.D.	N.D.
Dichloroethane	N.D.	N.D.
Dichloroethene	N.D.	N.D.
Dimethyl Sulfide	N.D.	N.D.
Dioxane	N.D.	N.D.
Ethyl Acetate	N.D.	N.D.
Ethyl Acrylate	N.D.	N.D.
Heptane	N.D.	N.D.
Hexane	Q.I.	Q.I.
Methyl Acetate	N.D.	N.D.
Methyl Acrylate	N.D.	N.D.
Methyl Chloroform	N.D.	N.D.
Methylene Chloride	N.D.	N.D.
Methyl Ethyl Ketone	N.D.	N.D.
Methyl Isobutyl Ketone	N.D.	N.D.
Nitrobenzene	N.D.	N.D.
Octane	Q.I.	Q.I.

(continued)

TABLE 5-1 (continued)

RESULT SUMMARY OF QUALITATIVE SITE CHARACTERIZATION

Target Compound	Meteorological Station	Site Downwind Along Shram Rd
Phenol	N.D.	N.D.
Pyridine	N.D.	N.D.
Styrene	N.D.	N.D.
Tetrachloroethane	N.D.	N.D.
Tetrachloroethene	N.D.	N.D.
Toluene	N.D.	Q.I.
Toluene Isocyanate	N.D.	N.D.
Trichloroethane	N.D.	N.D.
Trichloroethene	N.D.	N.D.
Trimethylbenzene	N.D.	N.D.
Vinyl Chloride	N.D.	N.D.
Xylene	N.D.	N.D.
Other Compounds		
Cyclohexanone	Q.I.	Q.I.
Heptene	Q.I.	Q.I.
Hexanone	Q.I.	Q.I.
Pentanone	Q.I.	Q.I.
Terpenes	N.D.	Q.I.

Q.I. Qualitatively Identified
N.D. Not Detected

TABLE 5-2 - 10 July 1986

RESULT SUMMARY OF QUALITATIVE SITE CHARACTERIZATION

Target Compound	Meteorological Station	Site Downwind Along Shram Rd
Acetone	Q.I.	Q.I.
Acrylonitrile	N.D.	N.D.
Allyl Chloride	N.D.	N.D.
Aniline	N.D.	N.D.
Benzene	N.D.	N.D.
Bromochloromethane	N.D.	N.D.
Bromomethane	N.D.	N.D.
Bromodichloromethane	N.D.	N.D.
Bromoform	N.D.	N.D.
Butyl Acetate	N.D.	N.D.
Carbon Disulfide	N.D.	N.D.
Carbon Tetrachloride	N.D.	N.D.
Chlorobenzene	N.D.	N.D.
Chloroform	N.D.	N.D.
Cresol	N.D.	N.D.
Dibromomethane	N.D.	N.D.
Dibromochloromethane	N.D.	N.D.
Dichlorobenzene	N.D.	N.D.
Dichloroethane	N.D.	N.D.
Dichloroethene	N.D.	N.D.
Dimethyl Sulfide	N.D.	N.D.
Dioxane	N.D.	N.D.
Ethyl Acetate	N.D.	N.D.
Ethyl Acrylate	N.D.	N.D.
Heptane	N.D.	N.D.
Hexane	Q.I.	Q.I.
Methyl Acetate	N.D.	N.D.
Methyl Acrylate	N.D.	N.D.
Methyl Chloroform	N.D.	N.D.
Methylene Chloride	N.D.	N.D.
Methyl Ethyl Ketone	N.D.	N.D.
Methyl Isobutyl Ketone	N.D.	N.D.
Nitrobenzene	N.D.	N.D.
Octane	Q.I.	Q.I.

(continued)

TABLE 5-2 (continued)

RESULT SUMMARY OF QUALITATIVE SITE CHARACTERIZATION

Target Compound	Meteorological Station	Site Downwind Along Shram Rd
Phenol	N.D.	N.D.
Pyridine	N.D.	N.D.
Styrene	N.D.	N.D.
Tetrachloroethane	N.D.	N.D.
Tetrachloroethene	N.D.	N.D.
Toluene	N.D.	N.D.
Toluene Isocyanate	N.D.	N.D.
Trichloroethane	N.D.	N.D.
Trichloroethene	N.D.	N.D.
Trimethylbenzene	N.D.	N.D.
Vinyl Chloride	N.D.	N.D.
Xylene	N.D.	N.D.
Other Compounds		
Cyclohexanone	Q.I.	Q.I.
Heptene	Q.I.	Q.I.
Hexanone	Q.I.	Q.I.
Pentanone	Q.I.	Q.I.
Terpenes	N.D.	N.D.

Q.I. Qualitatively Identified
N.D. Not Detected

TABLE 5-3 - 9 October 1986

RESULT SUMMARY OF QUALITATIVE SITE CHARACTERIZATION

Target Compound	Meteorological Station	Site Downwind Along Shram Rd
Acetone	N.D.	N.D.
Acrylonitrile	N.D.	N.D.
Allyl Chloride	N.D.	N.D.
Aniline	N.D.	N.D.
Benzene	N.D.	N.D.
Bromochloromethane	N.D.	N.D.
Bromomethane	N.D.	N.D.
Bromodichloromethane	N.D.	N.D.
Bromoform	N.D.	N.D.
Butyl Acetate	N.D.	N.D.
Carbon Disulfide	N.D.	N.D.
Carbon Tetrachloride	N.D.	N.D.
Chlorobenzene	N.D.	N.D.
Chloroform	N.D.	N.D.
Cresol	N.D.	N.D.
Dibromomethane	N.D.	N.D.
Dibromochloromethane	N.D.	N.D.
Dichlorobenzene	N.D.	N.D.
Dichloroethane	N.D.	N.D.
Dichloroethene	N.D.	N.D.
Dimethyl Sulfide	N.D.	N.D.
Dioxane	N.D.	N.D.
Ethyl Acetate	N.D.	N.D.
Ethyl Acrylate	N.D.	N.D.
Heptane	N.D.	N.D.
Hexane	N.D.	N.D,
Methyl Acetate	N.D.	N.D.
Methyl Acrylate	N.D.	N.D.
Methyl Chloroform	N.D.	N.D.
Methylene Chloride	N.D.	N.D.
Methyl Ethyl Ketone	N.D.	N.D.
Methyl Isobutyl Ketone	N.D.	N.D.
Nitrobenzene	N.D.	N.D.
Octane	N.D.	N.D.

(continued)

TABLE 5-3 (continued)

RESULT SUMMARY OF QUALITATIVE SITE CHARACTERIZATION

Target Compound	Meteorological Station	Site Downwind Along Shram Rd
Phenol	N.D.	N.D.
Pyridine	N.D.	N.D.
Styrene	N.D.	N.D.
Tetrachloroethane	N.D.	N.D.
Tetrachloroethene	N.D.	N.D.
Toluene	N.D.	N.D.
Toluene Isocyanate	N.D.	N.D.
Trichloroethane	N.D.	N.D.
Trichloroethene	N.D.	N.D.
Trimethylbenzene	N.D.	N.D.
Vinyl Chloride	N.D.	N.D.
Xylene	N.D.	N.D.
Other Compounds		
Cyclohexanone	N.D.	N.D.
Heptene	N.D.	N.D.
Hexanone	N.D.	N.D.
Pentanone	N.D.	N.D.
Terpenes	N.D.	N.D.

N.D. Not Detected

TABLE 5-4 - 12 April 1986

TIME-WEIGHTED AVERAGES AT METEOROLOGICAL STATION
(concentration in ppb)

Compound	Zero Air (Detection Limits)	12:47-12:57	13:02-13:12	13:18-13:28	13:37-13:47	13:56-14:06	14:17-14:27
Methyl Acrylate	1	-	N.D.	-	N.D.	-	N.D.
Chloroform	8	-	N.D.	-	N.D.	-	N.D.
Chlorobenzene	1	-	N.D.	-	N.D.	-	N.D.
Heptane	5	-	N.D.	-	N.D.	-	N.D.
Toluene	1	N.D.	-	N.D.	-	N.D.	-
Methyl Ethyl Ketone	1	N.D.	-	N.D.	-	N.D.	-
Butyl Acetate	1	N.D.	-	N.D.	-	N.D.	-
Benzene	2	N.D.	-	N.D.	-	N.D.	-

\- Not Monitored
N.D. Not Detected

TABLE 5-5 - 10 July 1986

TIME-WEIGHTED AVERAGES AT METEOROLOGICAL STATION
(concentration in ppb)

Compound	Zero Air (Detection Limits)	11:55-12:05	12:25-12:35	12:49-12:59	13:12-13:22	13:36-13:46	13:58-14:08
Toluene	4	N.D.	-	N.D.	-	N.D.	-
Butyl Acetate	1	N.D.	-	N.D.	-	N.D.	-
Chlorobenzene	1	N.D.	-	N.D.	-	N.D.	-
Methyl Ethyl Ketone	3	N.D.	-	N.D.	-	N.D.	
Heptane	8	-	N.D.	-	N.D.	-	N.D.
Benzene	6	-	N.D.	-	N.D.	-	N.D.
Methyl Acrylate	1	-	N.D.	-	N.D.	-	N.D.
Chloroform	19	-	N.D.	-	N.D.	-	N.D.

\- Not Monitored
N.D. Not Detected

TABLE 5-6 - 9 October 1986

TIME-WEIGHTED AVERAGES AT METEOROLOGICAL STATION
(concentration in ppb)

Compound	Zero Air (Detection Limits)	13:12-13:22	13:43-13:53	14:02-14:12	14:24-14:34	17:04-17:14	17:26-17:36
Toluene	4	N.D.	N.D.	-	-	N.D.	-
Butyl Acetate	2	N.D.	N.D.	-	-	N.D.	-
Methyl Ethyl Ketone	10	N.D.	N.D.	-	-	N.D.	-
Benzene	7	N.D.	N.D.	-	-	N.D.	-
Heptane	10	-	-	N.D.	N.D.	-	N.D.
Chlorobenzene	1		-	N.D.	N.D.	- .	N.D.
Methyl Acrylate	4	-	-	N.D.	N.D.	-	N.D.
Chloroform	19	-	-	N.D.	N.D.	-	N.D.

\- Not Monitored
N.D. Not Detected

TABLE 5-7 - 12 April 1986

TIME WEIGHTED AVERAGES
AT SHRAM ROAD LOCATION
(concentration in ppb)

Compound	Zero Air (Detection Limits)	16:40-16:50	17:03-17:13
Methyl Acrylate	1	N.D.	-
Chloroform	8	N.D.	-
Chlorobenzene	1	N.D.	-
Heptane	5	N.D.	-
Toluene	1	-	4
Methyl Ethyl Ketone	1	-	N.D.
Butyl Acetate	1	-	N.D.
Benzene	2	-	5

\- Not Monitored
N.D. Not Detected

TABLE 5-8 - 10 July 1986

TIME-WEIGHTED AVERAGES AT METEOROLOGICAL STATION
(concentration in ppb)

Compound	Zero Air (Detection Limits)	15:35-15:45	15:59-16:09	16:22-16:32	16:44-16:54	13:36-13:46	13:58-14:08
Toluene	4	N.D.	-	N.D.	-	N.D.	-
Butyl Acetate	1	N.D.	-	N.D.	-	N.D.	-
Chlorobenzene	1	N.D.	-	N.D.	-	N.D.	-
Methyl Ethyl Ketone	3	N.D.	-	N.D.	-	N.D.	
Heptane	8	-	N.D.	-	N.D.	-	N.D.
Benzene	6	-	N.D.	-	N.D.	-	N.D.
Methyl Acrylate	1	-	N.D.	-	N.D.	-	N.D.
Chloroform	19	-	N.D.	-	N.D.	-	N.D.

\- Not Monitored
N.D. Not Detected

TABLE 5-9 - 9 October 1986

TIME-WEIGHTED AVERAGES AT SHRAM ROAD LOCATION
(concentration in ppb)

Compound	Zero Air (Detection Limits)	15:48-15:58	16:05-16:15	16:22-16:32	16:41-16:51
Toluene	4	N.D.	-	-	N.D.
Butyl Acetate	2	N.D.	-	-	N.D.
Methyl Ethyl Ketone	10	N.D.	-	-	N.D.
Benzene	7	N.D.	-	-	N.D.
Heptane	10	-	N.D.	N.D.	-
Chlorobenzene	1	-	N.D.	N.D.	-
Methyl Acrylate	4	-	N.D.	N.D.	-
Chloroform	19	-	N.D.	N.D.	-

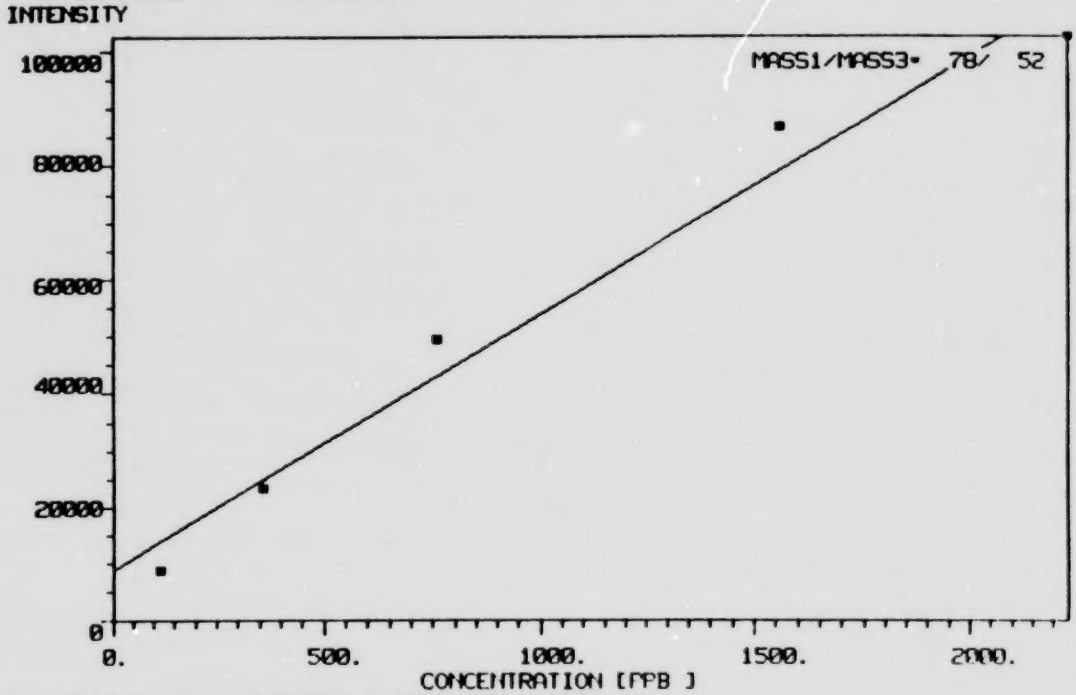
\- Not Monitored
N.D. Not Detected

APPENDIX

CALIBRATION CURVES

April 12, 1986

12-APR-86 A1 5866.5 DI -1.0000 CG 25.545
09:57:52 A2 1991.4 VL OFF

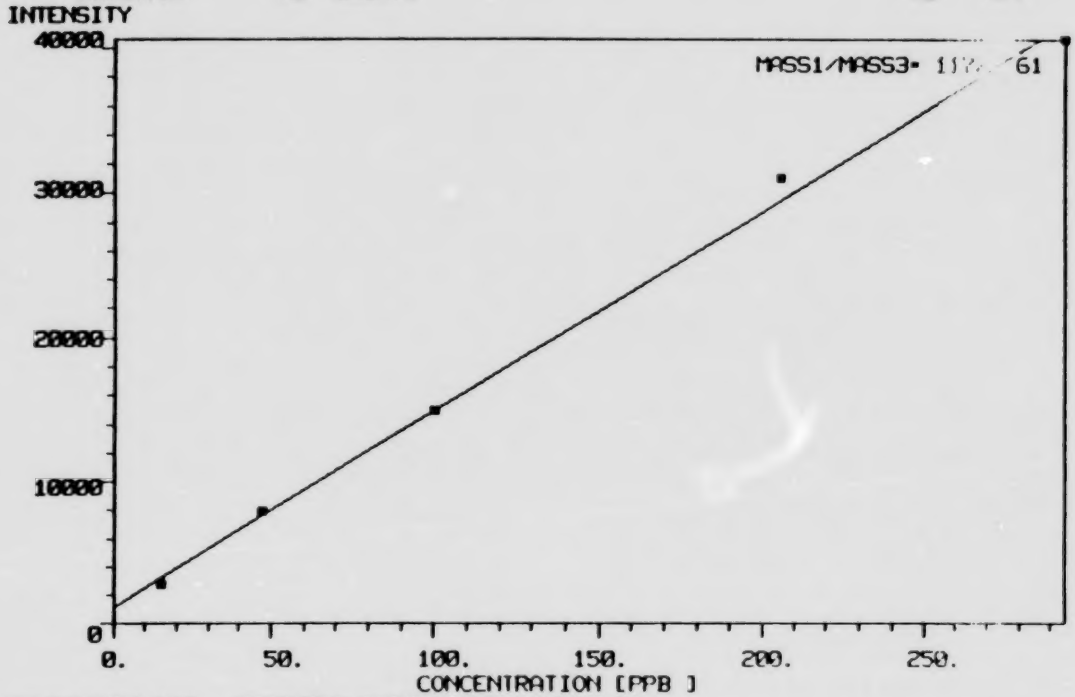


CALCULATED FIT - MEASURED POINTS AND LINEAR FIT
BENZENE CALIBRATION

LEAST SQUARES LINEAR REGRESSION RESULTS

MASS1/MASS3	N	SLOPE	INTERCEPT	R2
78.0/ 52.0	5.	44.92791	8872.789	0.9861
78.0/ 39.0	5.	55.41488	12921.79	0.9834

12-APR-86 A1 5927.3 DI -1.0125 CG 32.095
10:04:59 A2 2010.3 VL OFF



CALCULATED FIT - MEASURED POINTS AND LINEAR FIT
BUTYL ACETATE CALIBRATION

LEAST SQUARES LINEAR REGRESSION RESULTS

MASS1/MASS3	N	SLOPE	INTERCEPT	R2
117.0/ 61.0	5.	137.2470	1200.575	0.9981
117.0/ 57.0	5.	168.7480	1265.018	0.9985

12-APR-86 A1 5913.8 DI -1.0000 CG 28.000
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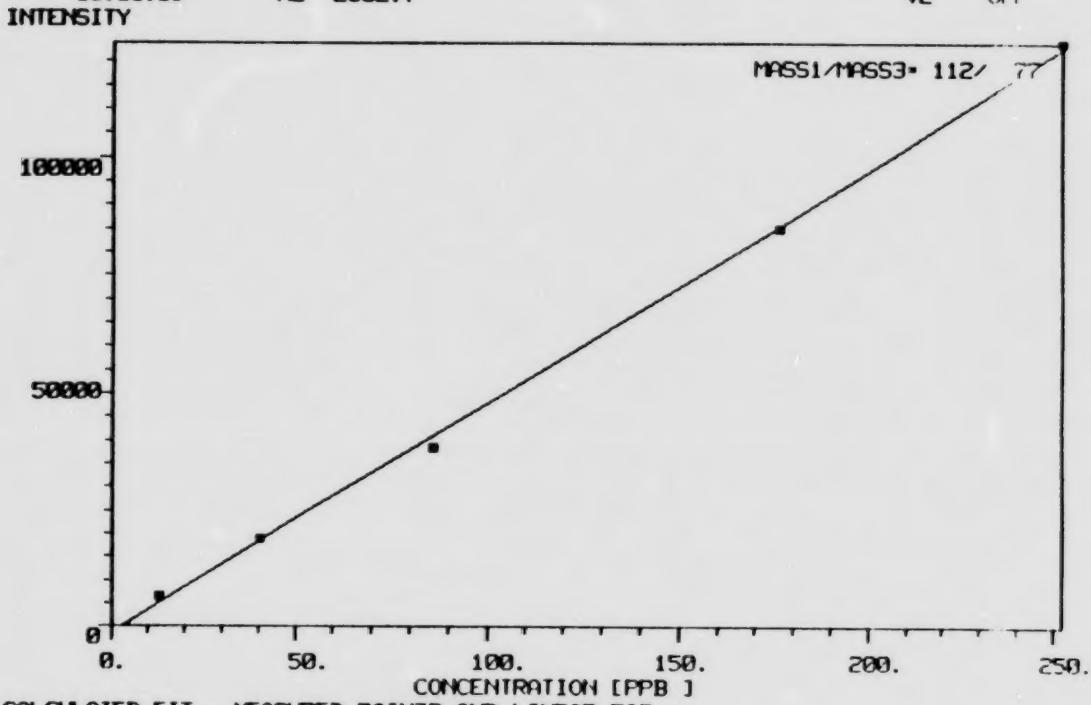
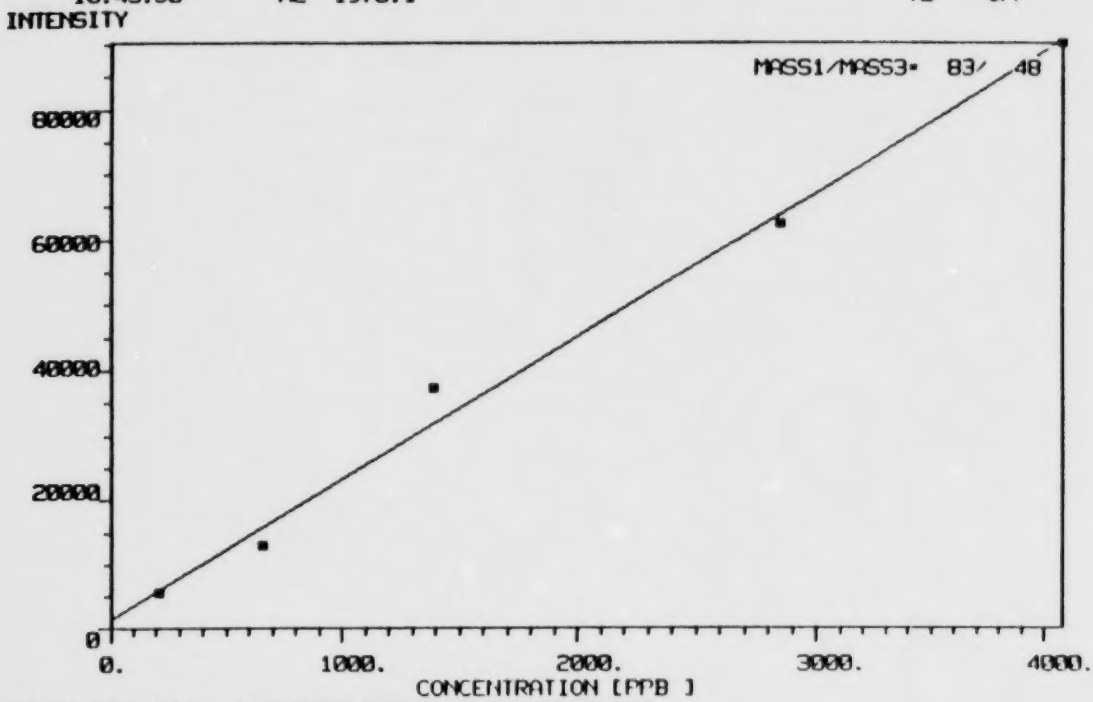


CALCULATED FIT - MEASURED POINTS AND LINEAR FIT
CHLOROBENZENE CALIBRATION

LEAST SQUARES LINEAR REGRESSION RESULTS

MASS1/MASS3	N	SLOPE	INTERCEPT	R2
112.0/ 77.0	5.	492.3315	-1392.662	0.9995
112.0/ 51.0	5.	489.3644	-1328.706	0.9996

12-APR-86 A1 5927.3 DI -1.0000 CG 30.785
10:43:50 A2 1978.1 VL OFF

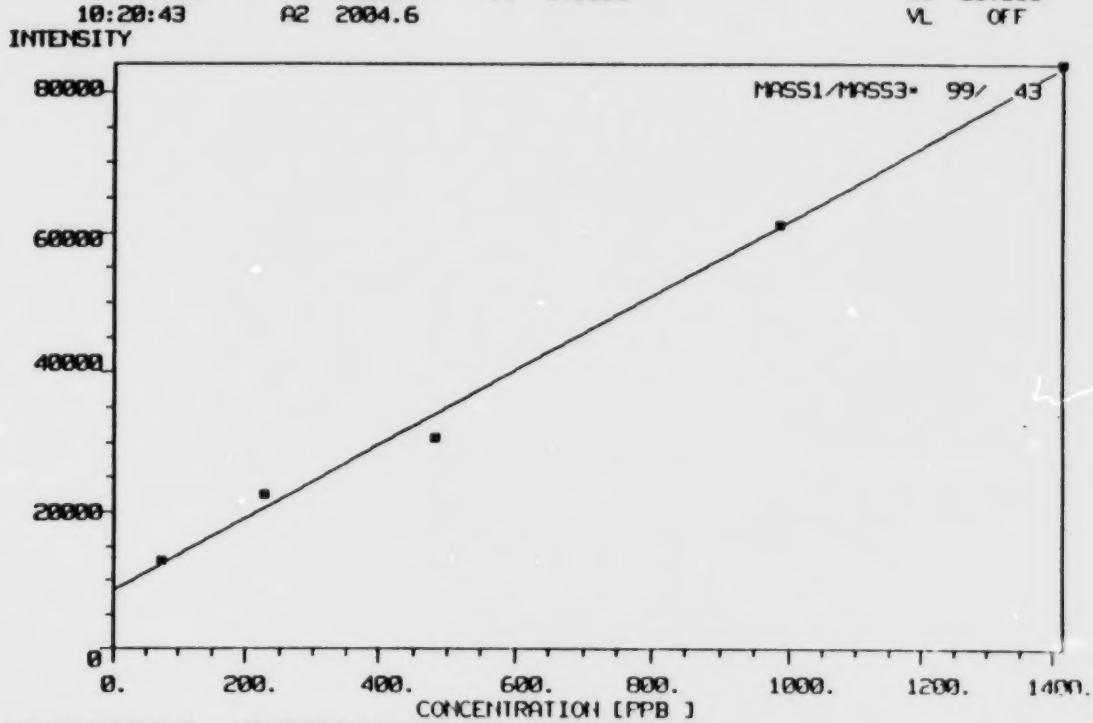


CALCULATED FIT - MEASURED POINTS AND LINEAR FIT
CHLOROFORM CALIBRATION

LEAST SQUARES LINEAR REGRESSION RESULTS

MASS1/MASS3	N	SLOPE	INTERCEPT	R2
83.0/ 48.0	5.	21.82358	1580.509	0.9958
85.0/ 50.0	5.	6.653258	-14.09142	0.9968

12-APR-86 A1 5967.4 DI -1.0050 CG 26.200
10:20:43 A2 2004.6 VL OFF

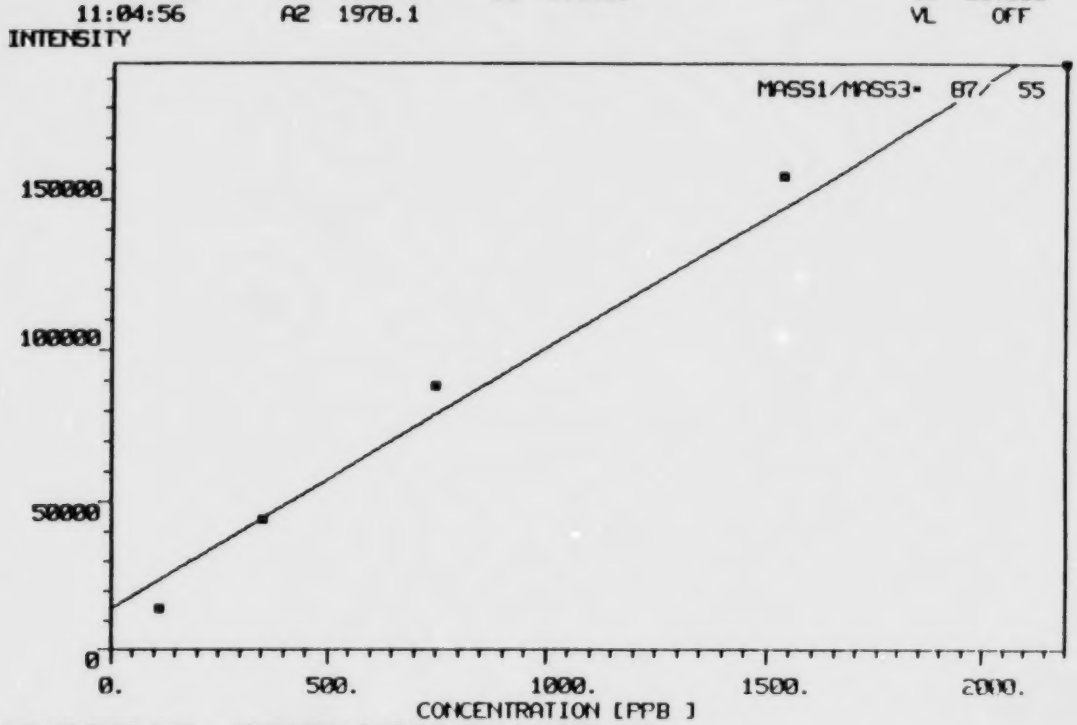


CALCULATED FIT - MEASURED POINTS AND LINEAR FIT
HEPTANE CALIBRATION

LEAST SQUARES LINEAR REGRESSION RESULTS

MASS1/MASS3	N	SLOPE	INTERCEPT	R2
99.0/ 43.0	5.	53.06303	8481.717	0.9978
99.0/ 29.0	5.	29.80548	2540.675	0.9983

12-APR-86 A1 5805.0 DI -1.0125 CG 26.200
11:04:56 A2 1978.1 VL OFF

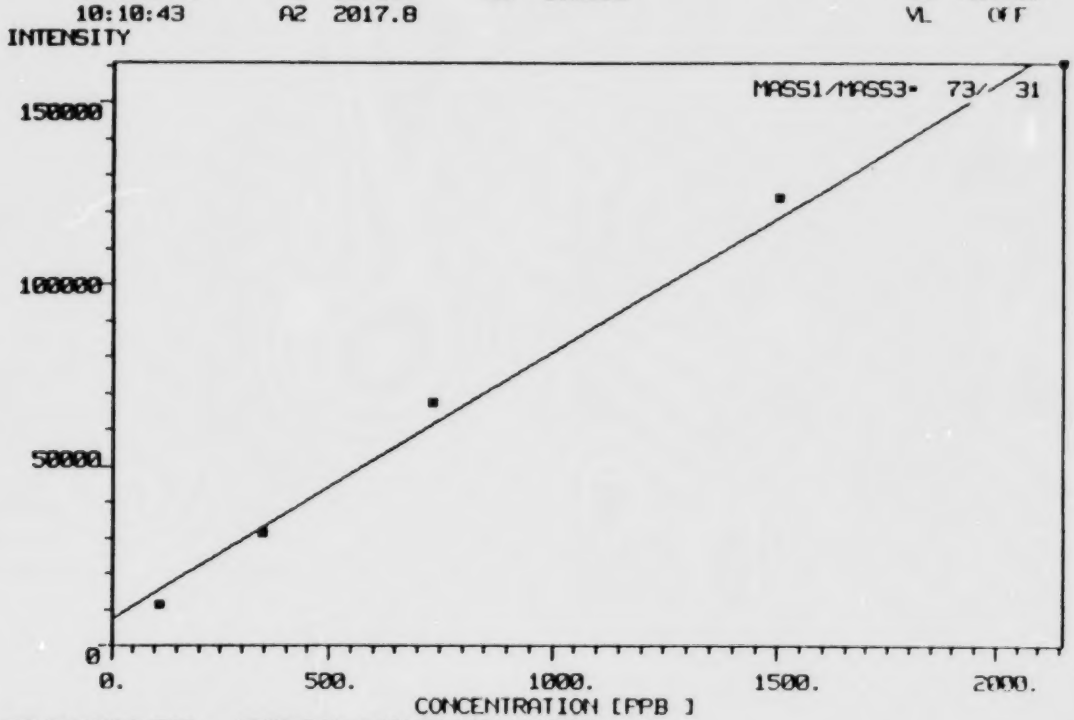


CALCULATED FIT - MEASURED POINTS AND LINEAR FIT
METHYL ACRYLATE CALIBRATION

LEAST SQUARES LINEAR REGRESSION RESULTS

MASS1/MASS3	N	SLOPE	INTERCEPT	P2
87.0/ 55.0	5.	87.01126	13639.13	0.9912
87.0/ 27.0	5.	51.57778	1888.264	0.9989

12-APR-86 A1 5859.7 DI -1.0080 CG 30.785
10:10:43 A2 2017.8 VL OFF

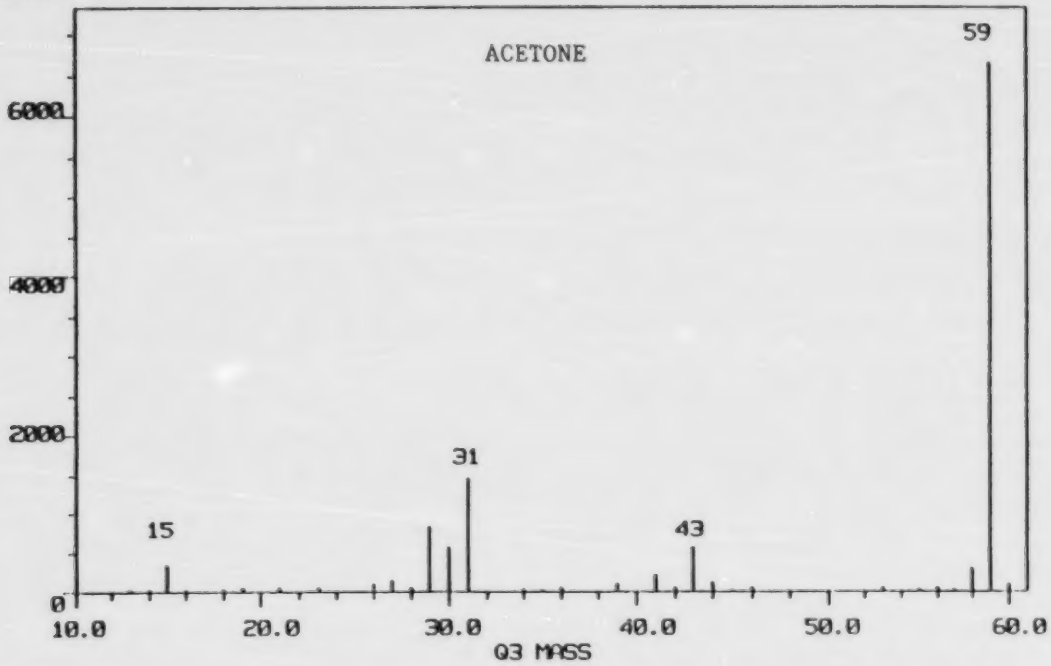


CALCULATED FIT - MEASURED POINTS AND LINEAR FIT
METHYL ETHYL KETONE CALIBRATION

LEAST SQUARES LINEAR REGRESSION RESULTS

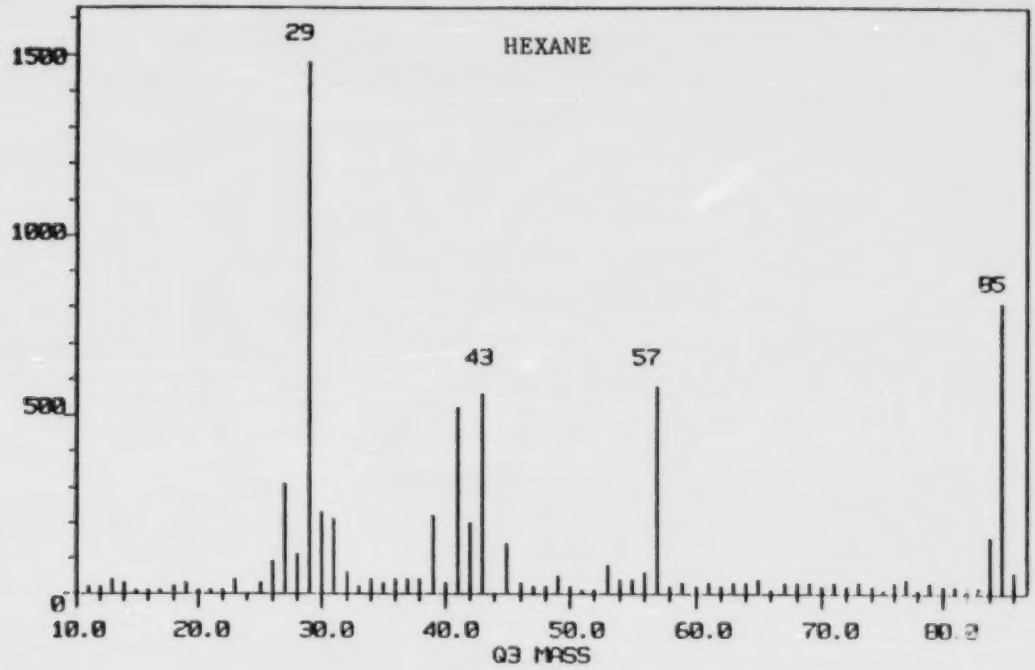
MASS1/MASS3	N	SLOPE	INTERCEPT	R2
73.0/ 31.0	5.	73.49321	7577.267	0.9963
73.0/ 43.0	5.	64.16799	4411.005	0.9982

DAUGHTER ION SPECTRUM FOR MASS 59 SCAN: 1



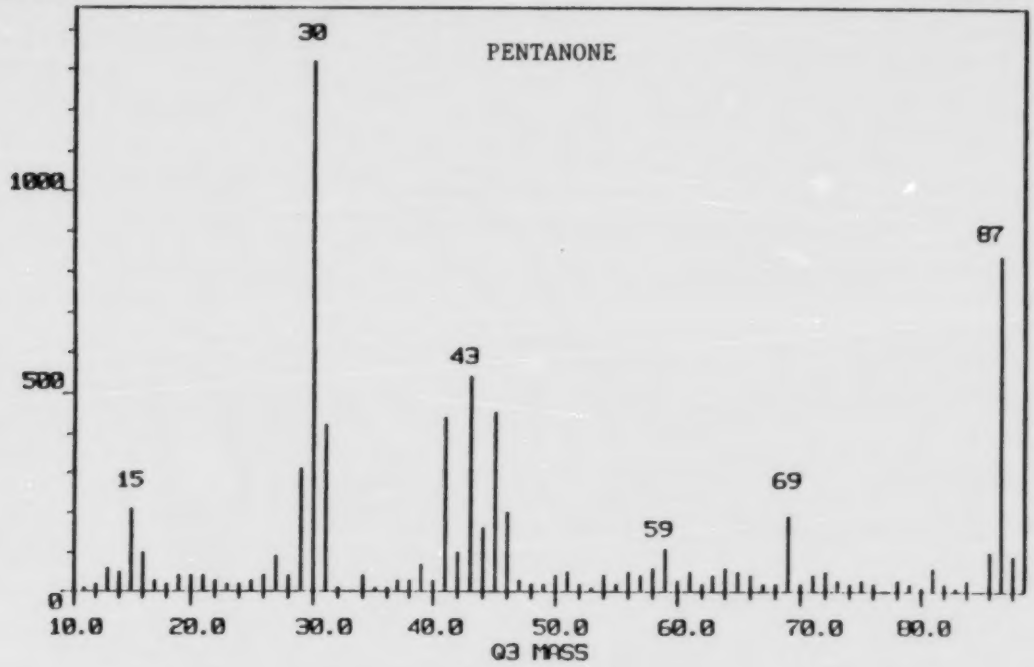
DAUGHTER SPECTRUM AT MET STATION

DAUGHTER ION SPECTRUM FOR MASS 85 SCAN: 1



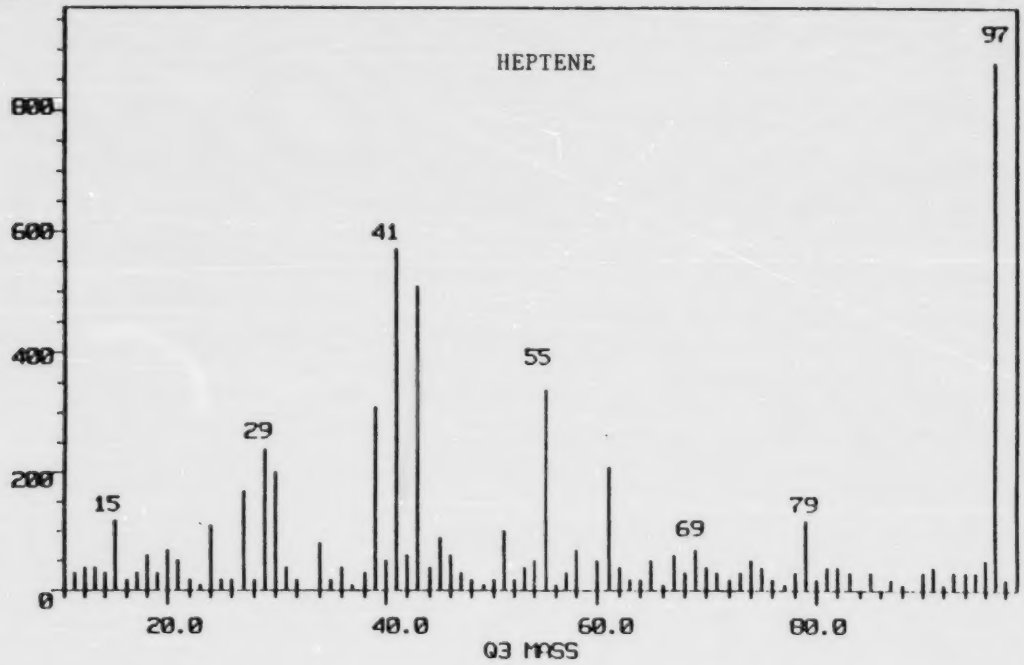
DAUGHTER SPECTRUM AT MET STATION

DAUGHTER ION SPECTRUM FOR MASS 87 SCAN: 1



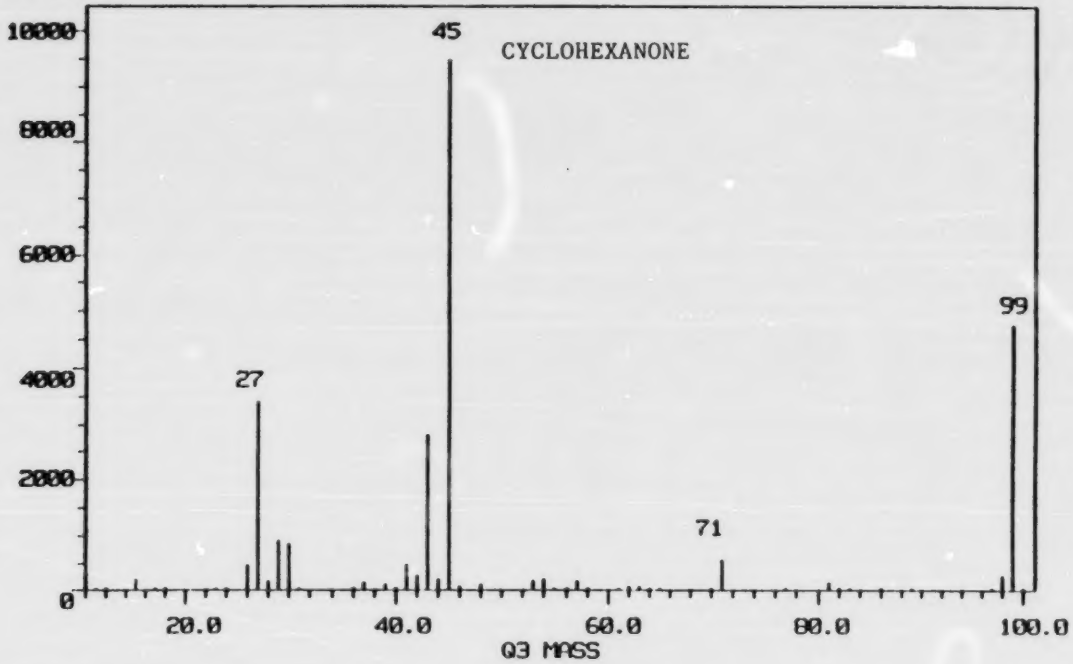
DAUGHTER SPECTRUM AT MET STATION

DAUGHTER ION SPECTRUM FOR MASS 97 SCAN: 1



DAUGHTER SPECTRUM AT MET STATION

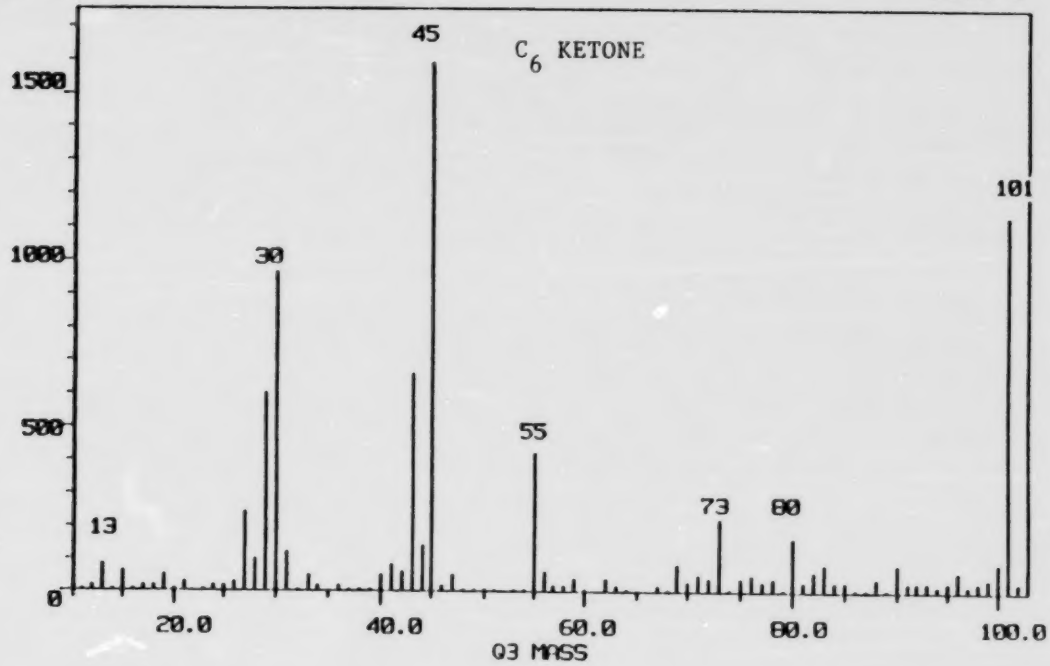
DAUGHTER ION SPECTRUM FOR MASS 99 SCAN: 1



DAUGHTER SPECTRUM AT MET STATION

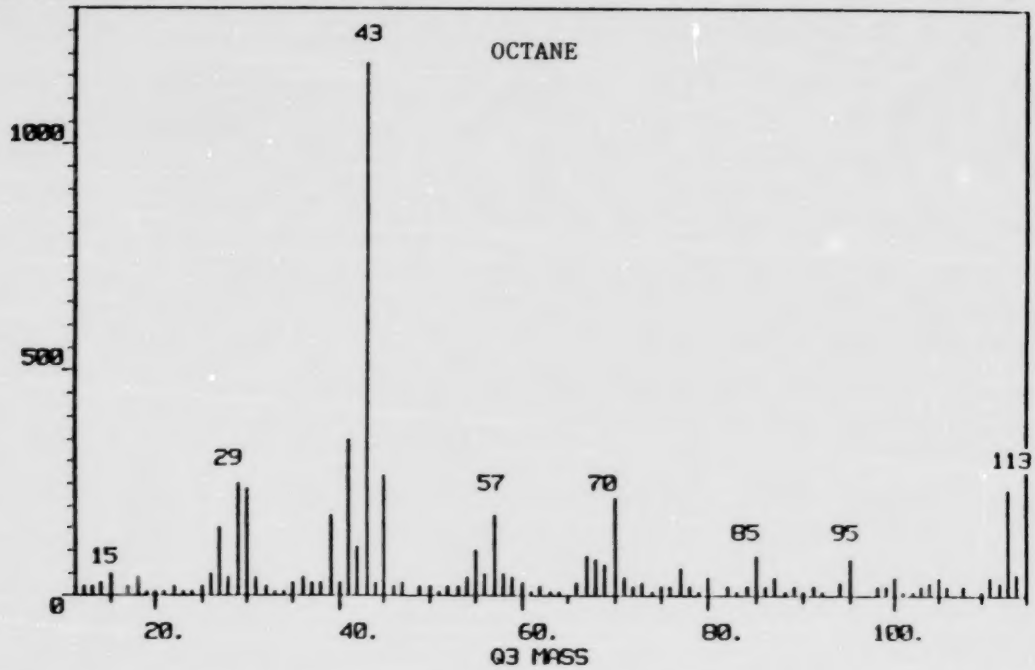
DAUGHTER ION SPECTRUM FOR MASS 101

SCAN: 1



DAUGHTER SPECTRUM AT MET STATION

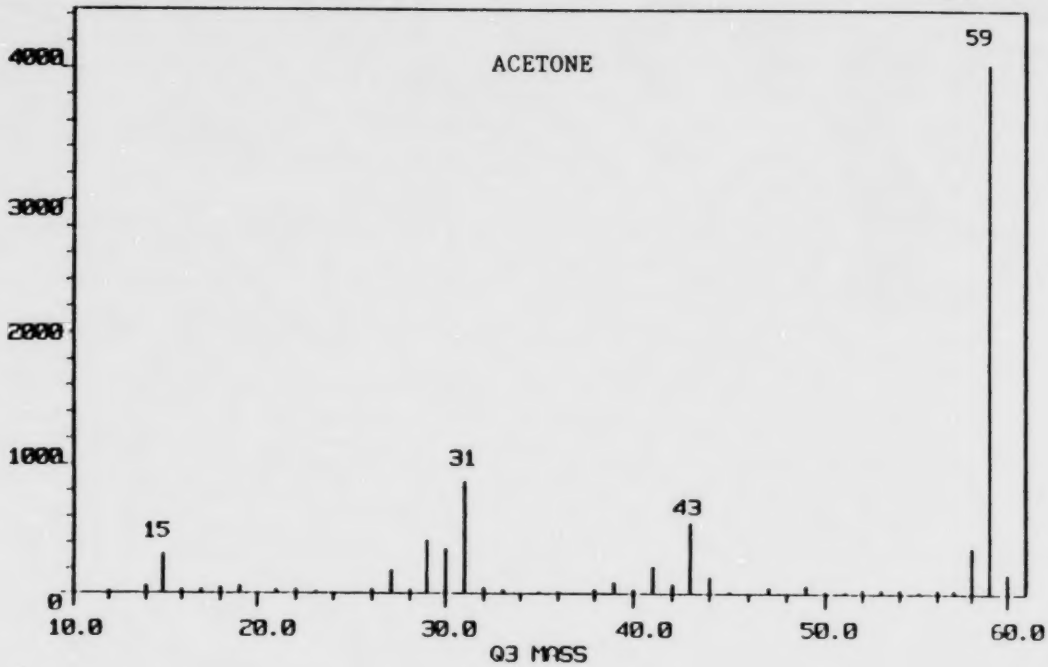
DAUGHTER ION SPECTRUM FOR MASS 113 SCAN: 1



DAUGHTER SPECTRUM AT MET STATION

CONFIRMING SPECTRA FOR
SHRAM ROAD

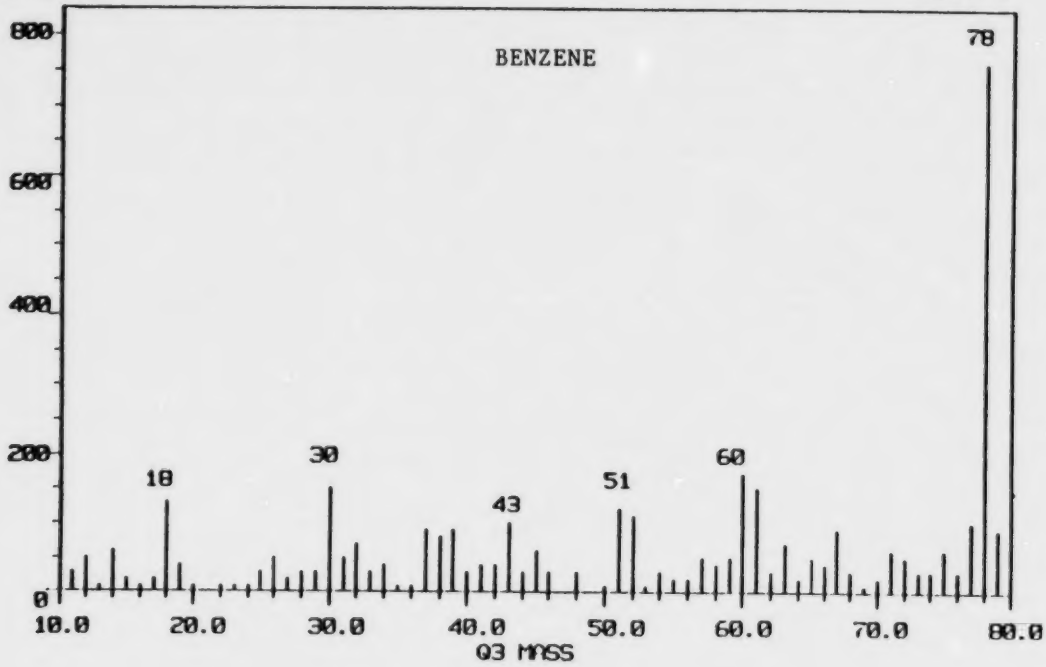
DAUGHTER ION SPECTRUM FOR MASS 59 SCAN: 1



50 METRES FROM HIGHWAY 20 ON SHRAM RD

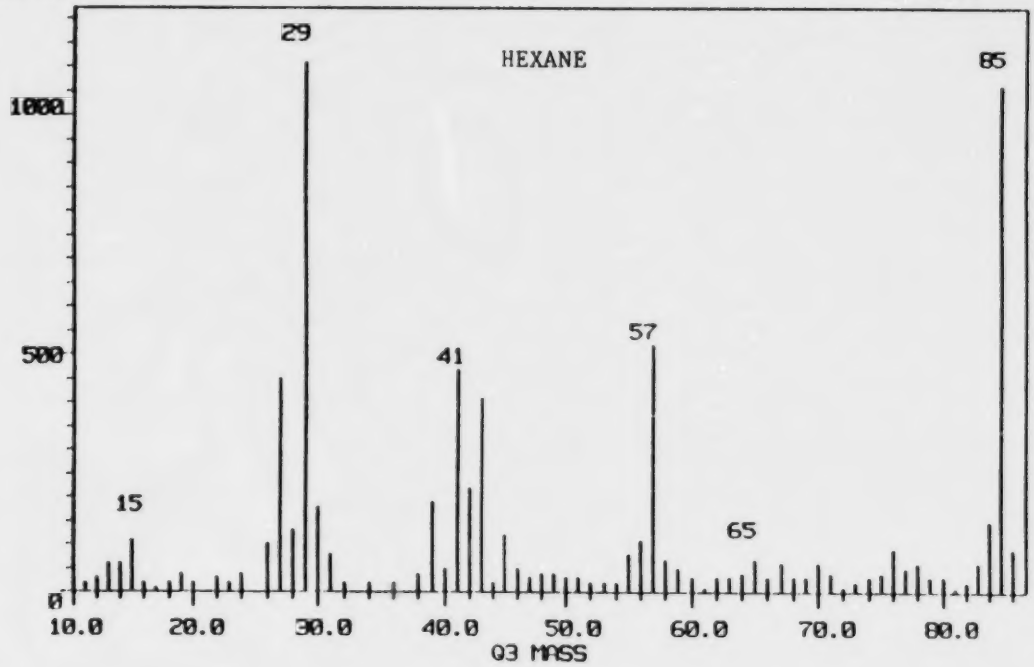
DAUGHTER ION SPECTRUM FOR MASS 78

SCAN: 1



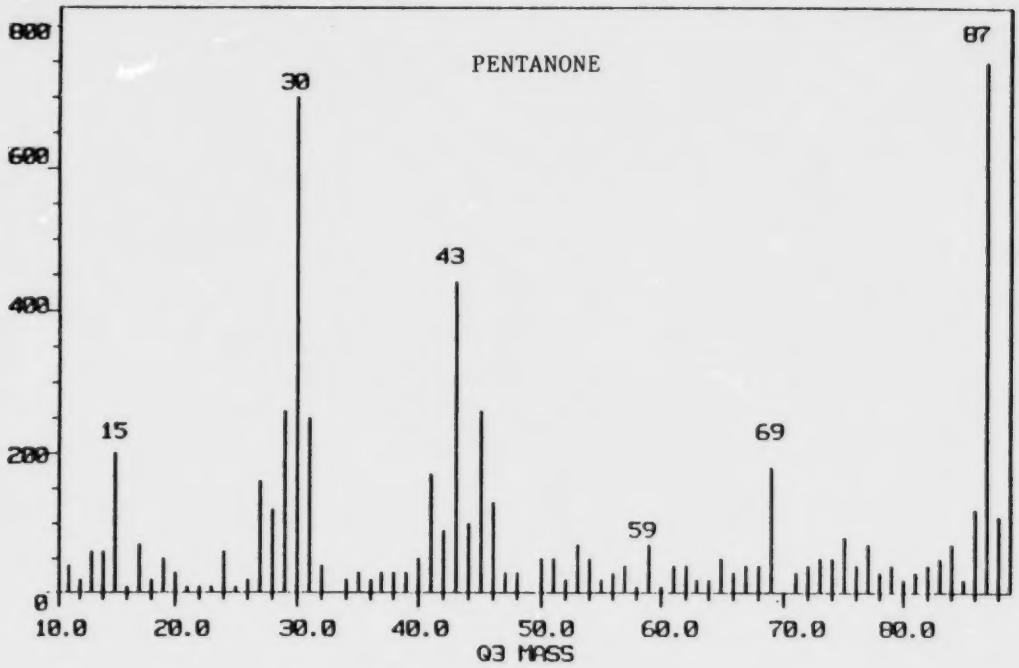
50 METRES FROM HIGHWAY 20 ON SHRAM RD

DAUGHTER ION SPECTRUM FOR MASS 85 SCAN: 1



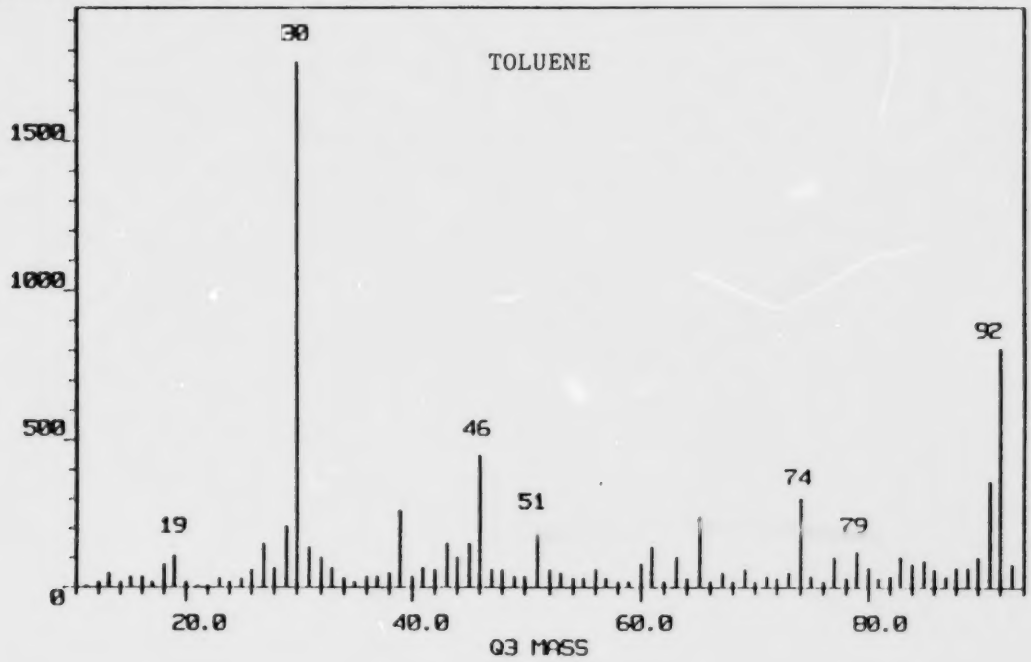
50 METRES FROM HIGHWAY 20 ON SHRAM RD

DAUGHTER ION SPECTRUM FOR MASS 87 SCAN: 1



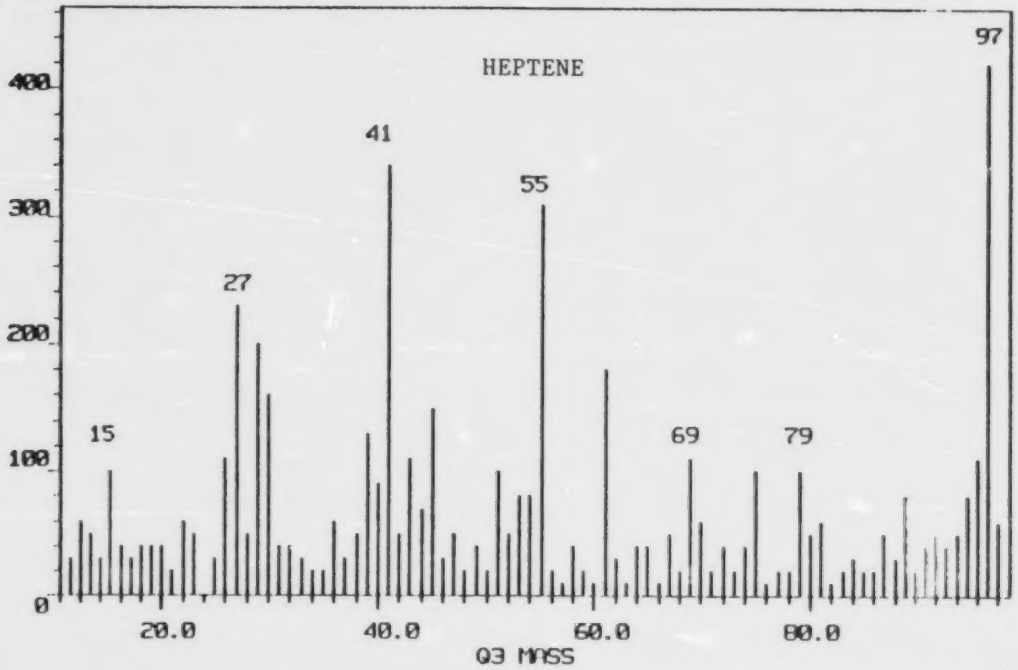
50 METRES FROM HIGHWAY 20 ON SHRAM RD

DAUGHTER ION SPECTRUM FOR MASS 92 SCAN: 1



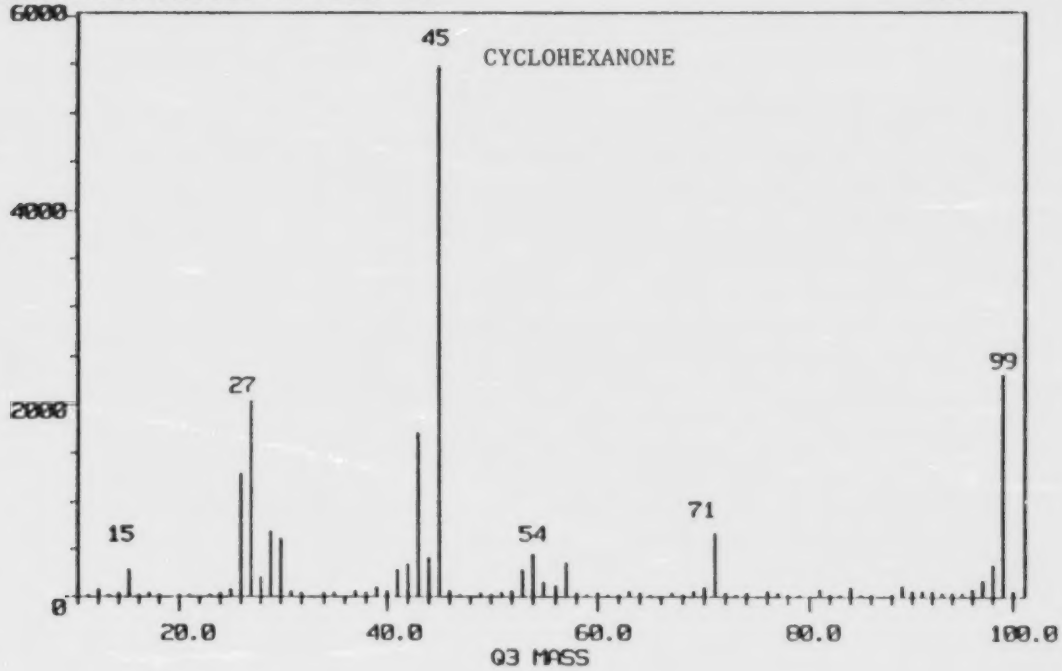
50 METRES FROM HIGHWAY 20 ON SHRAM RD

DAUGHTER ION SPECTRUM FOR MASS 97 SCAN: 1



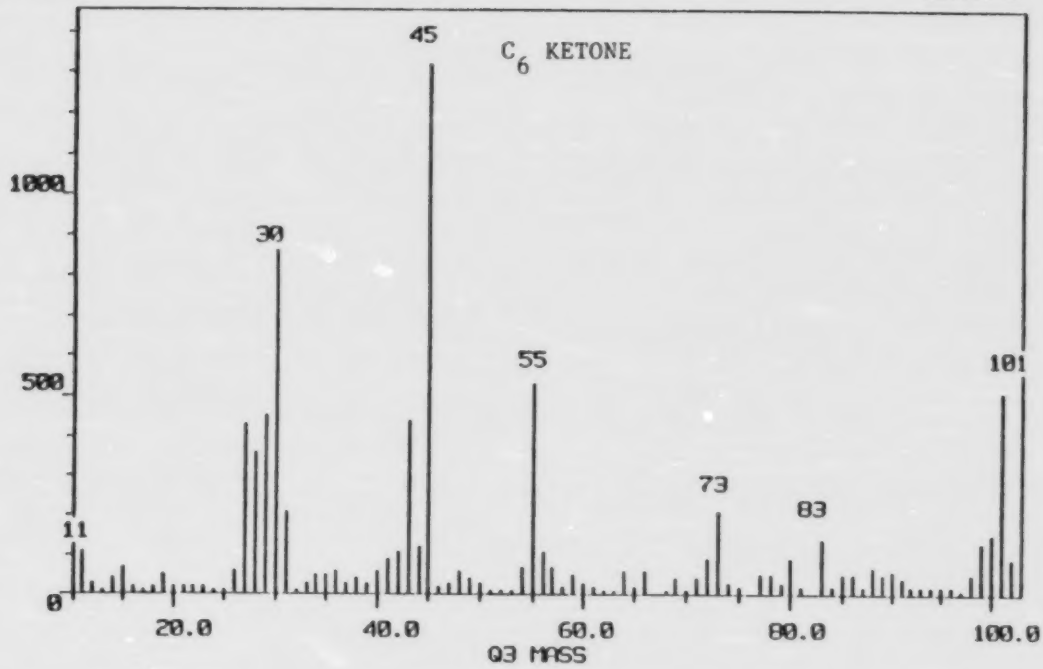
50 METRES FROM HIGHWAY 20 ON SHRAM RD

DAUGHTER ION SPECTRUM FOR MASS 99 SCAN: 1



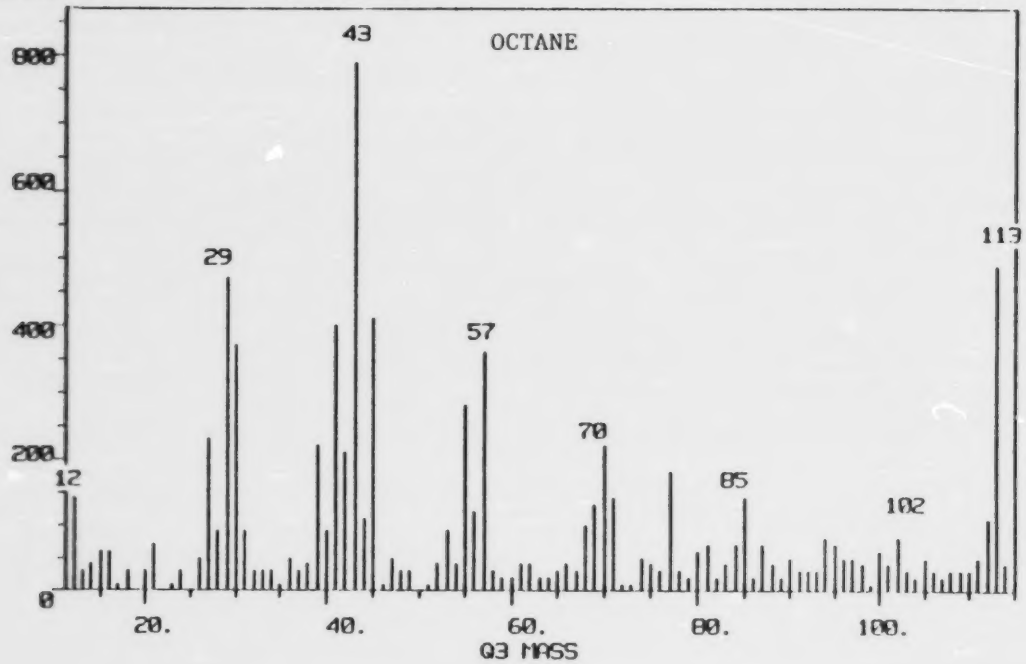
50 METRES FROM HIGHWAY 20 ON SHRAM RD

DAUGHTER ION SPECTRUM FOR MASS 101 SCAN: 1



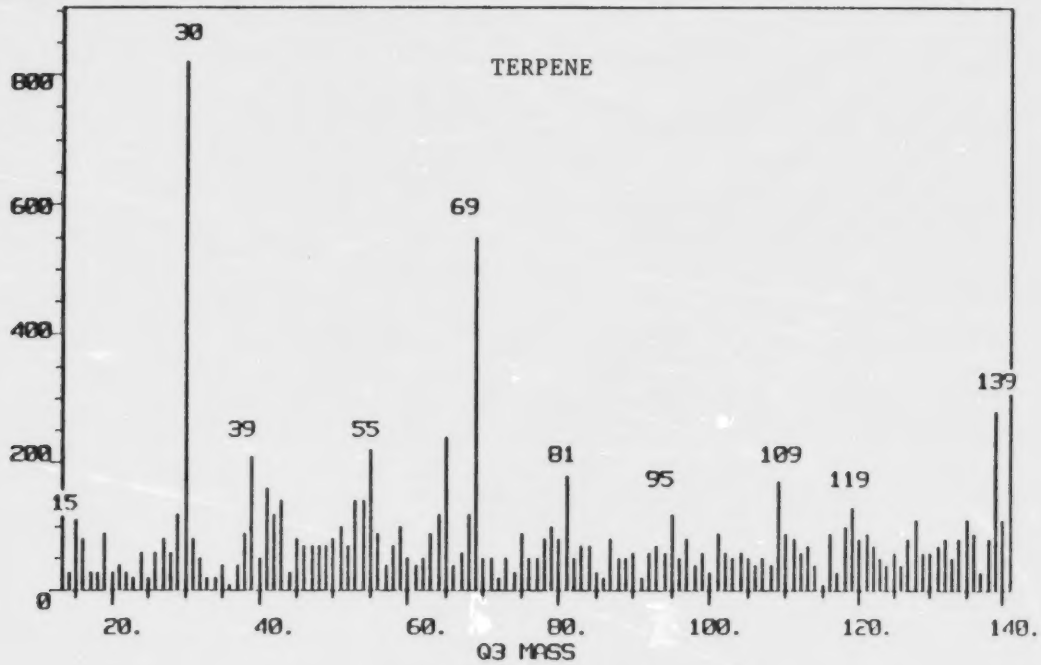
50 METRES FROM HIGHWAY 20 ON SHRAM RD

DAUGHTER ION SPECTRUM FOR MASS 113 SCAN: 1



50 METRES FROM HIGHWAY 20 ON SHRAM RD

DAUGHTER ION SPECTRUM FOR MASS 139 SCAN: 1

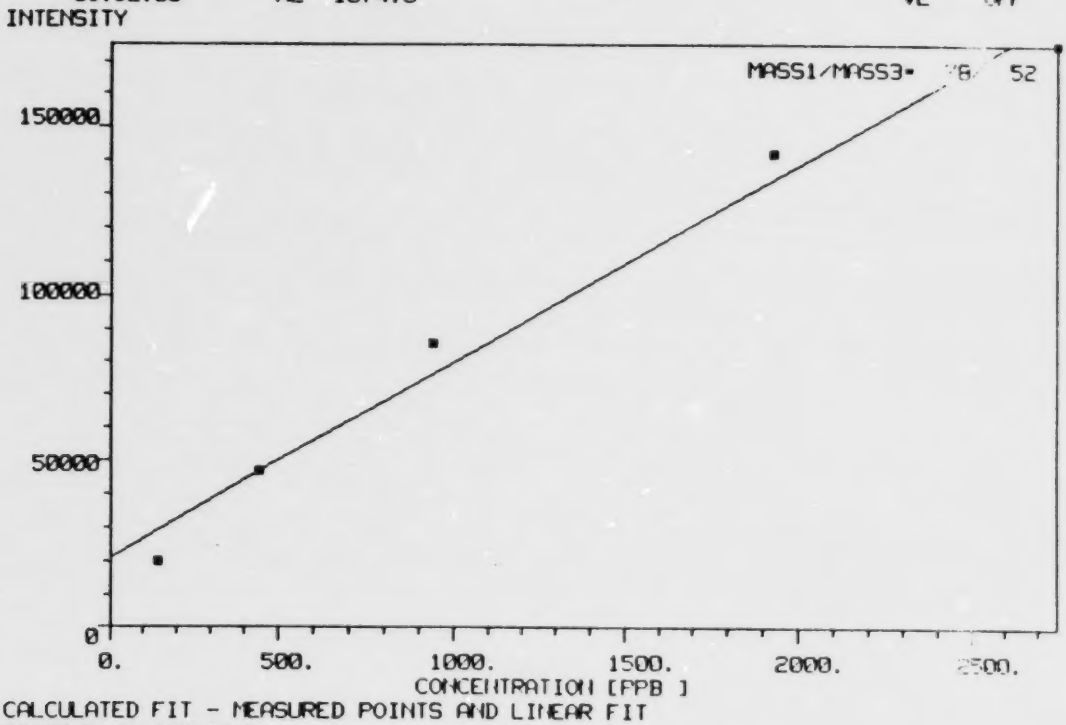


50 METRES FROM HIGHWAY 20 ON SHRAM RD

CALIBRATION CURVES

July 11, 1986

11-JUL-86 A1 7801.5 DI -1.0680 CG 304.57
09:52:06 A2 1874.6 VL OFF

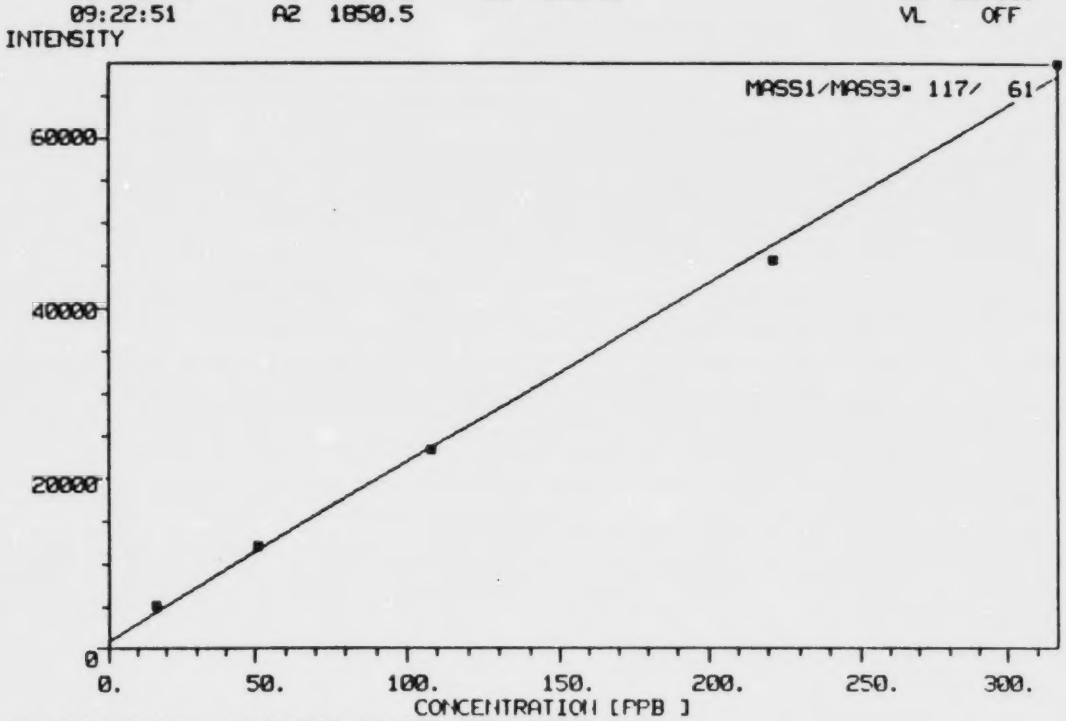


CALCULATED FIT - MEASURED POINTS AND LINEAR FIT
BENZENE CALIBRATION

LEAST SQUARES LINEAR REGRESSION RESULTS

MASS1/MASS3	N	SLOPE	INTERCEPT	R2
78.0/ 52.0	5.	58.83941	20785.18	0.9906
78.0/ 39.0	5.	46.25156	11106.05	0.9964

11-JUL-86 A1 5934.0 DI -1.0710 CG 20.305
09:22:51 A2 1850.5 VL OFF

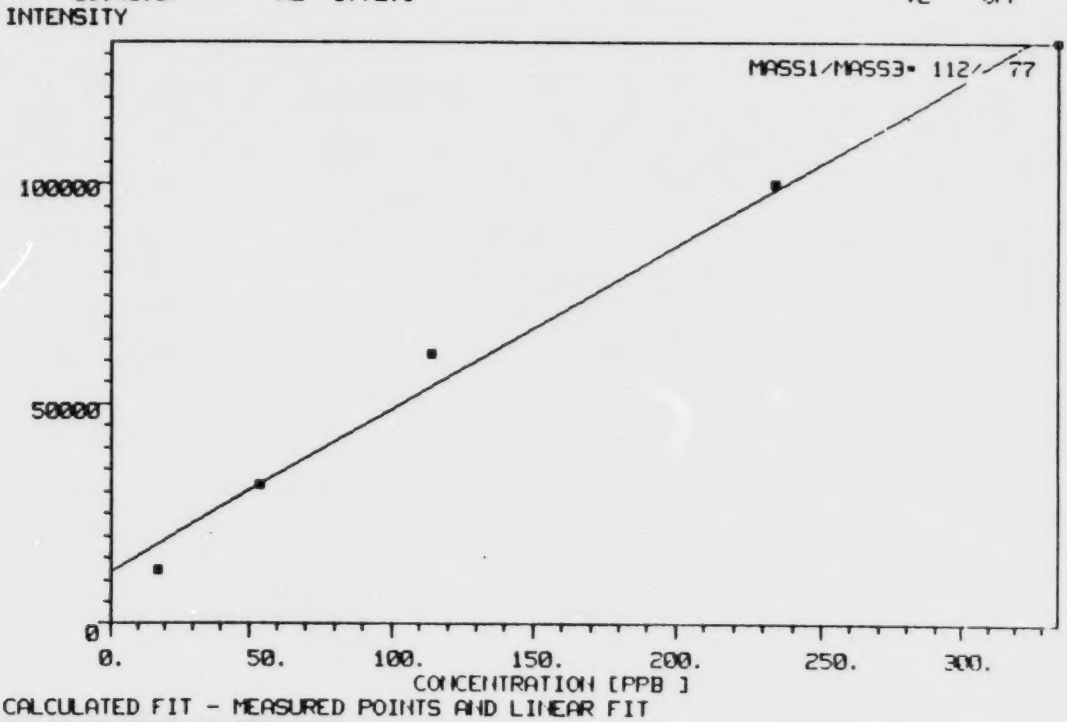


CALCULATED FIT - MEASURED POINTS AND LINEAR FIT
BUTYL ACETATE CALIBRATION

LEAST SQUARES LINEAR REGRESSION RESULTS

MASS1/MASS3	N	SLOPE	INTERCEPT	R2
117.0/ 61.0	5.	209.8755	1024.924	0.9989
117.0/ 57.0	5.	211.8524	483.5221	0.9982

11-JUL-86 A1 5742.9 DI -1.0710 CG 301.35
09:43:07 A2 1772.1 VL OFF



CALCULATED FIT - MEASURED POINTS AND LINEAR FIT
CHLOROBENZENE CALIBRATION

LEAST SQUARES LINEAR REGRESSION RESULTS

MASS1/MASS3	N	SLOPE	INTERCEPT	R2
112.0/ 77.0	5.	370.9173	11684.17	0.9944
112.0/ 51.0	5.	87.15448	1521.874	0.9987

11-JUL-86 A1 9106.7 DI -1.0635 CG 21.615
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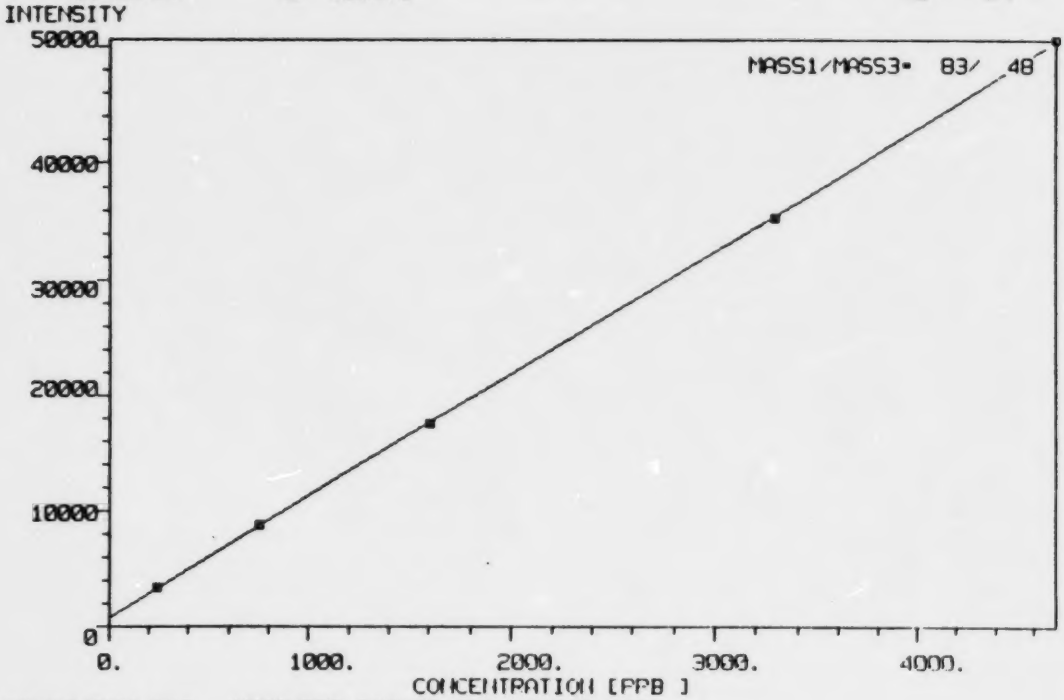
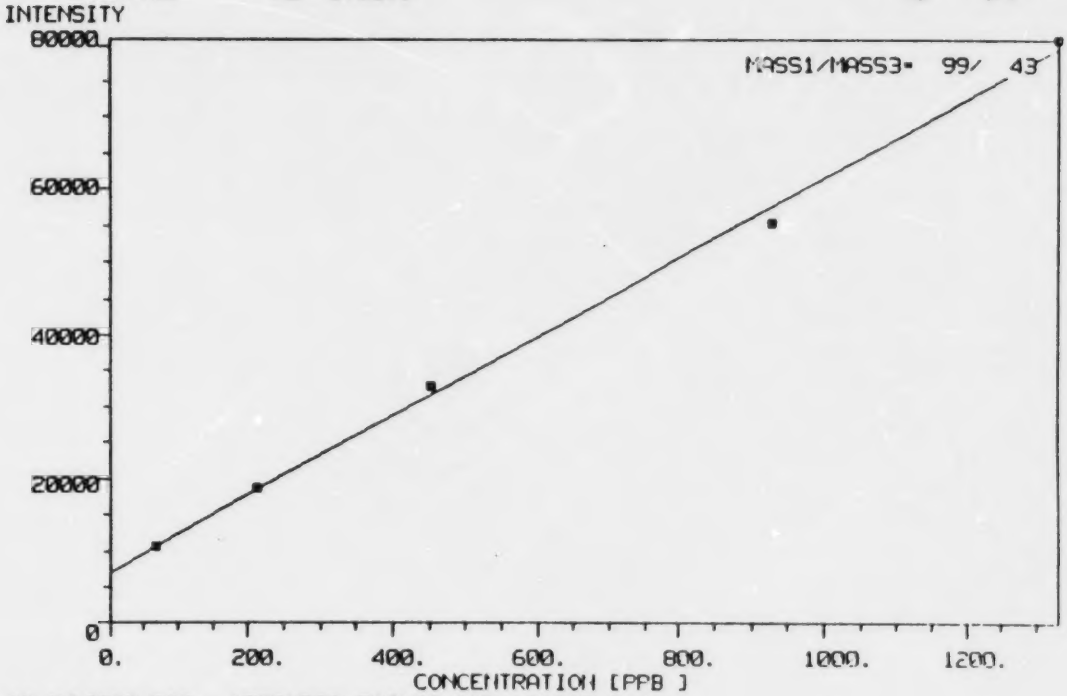


CALCULATED FIT - MEASURED POINTS AND LINEAR FIT
CHLOROFORM CALIBRATION

LEAST SQUARES LINEAR REGRESSION RESULTS

MASS1/MASS3	N	SLOPE	INTERCEPT	R2
83.0/ 48.0	5.	10.54652	793.8482	1.0000
85.0/ 50.0	5.	3.254874	317.2722	0.9998

11-JUL-86 A1 5763.7 DI -1.0710 CG 20.305
09:37:32 A2 1780.5 VL OFF

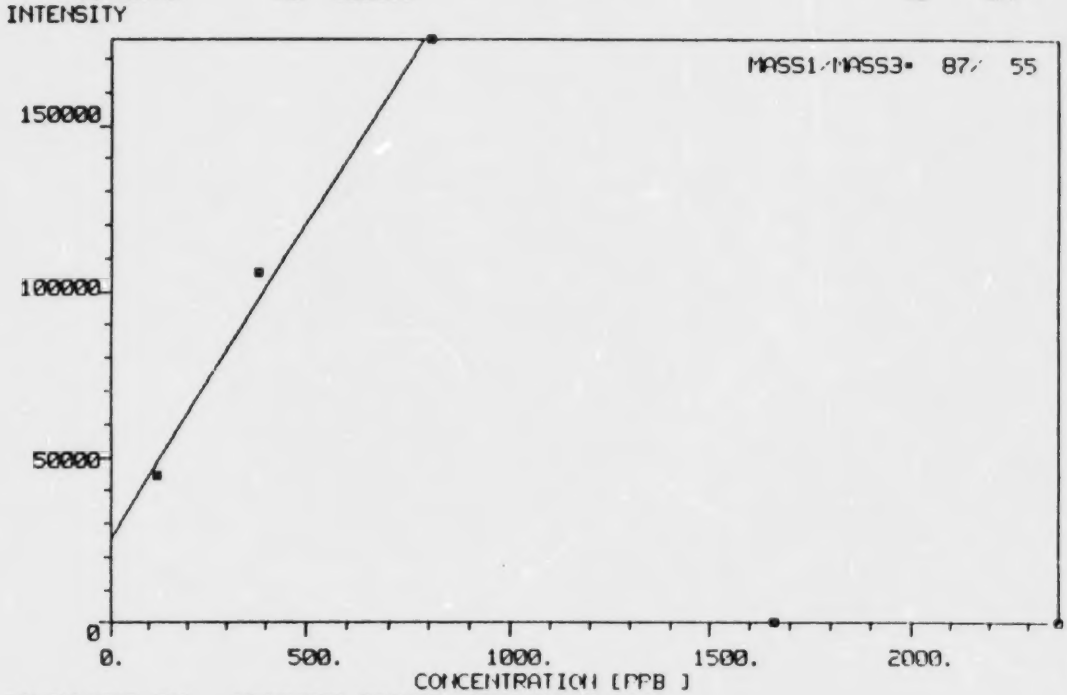


CALCULATED FIT - MEASURED POINTS AND LINEAR FIT
HEPTANE CALIBRATION

LEAST SQUARES LINEAR REGRESSION RESULTS

MASS1/MASS3	N	SLOPE	INTERCEPT	R2
99.0/ 43.0	5.	54.53515	7006.024	0.9988
99.0/ 29.0	5.	33.06024	2918.648	0.9985

11-JUL-86 A1 5927.3 DI -1.0695 CG 8.5150
10:16:46 A2 1838.3 VL OFF

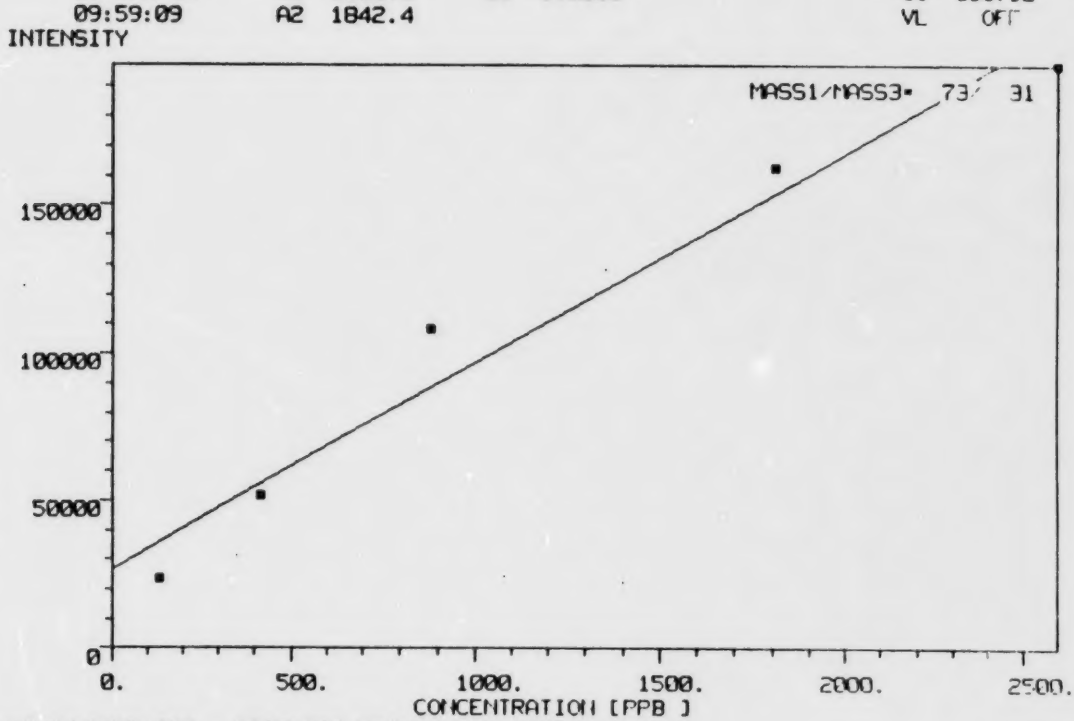


CALCULATED FIT - MEASURED POINTS AND LINEAR FIT
METHYL ACRYLATE CALIBRATION

LEAST SQUARES LINEAR REGRESSION RESULTS

MASS1/MASS3	N	SLOPE	INTERCEPT	R2
87.0/ 55.0	3.	189.2623	25416.45	0.9950
87.0/ 27.0	3.	67.73303	2643.198	1.0000

11-JUL-86 A1 5960.8 DI -1.0665 CG 303.92
09:59:09 A2 1842.4 VL OFF

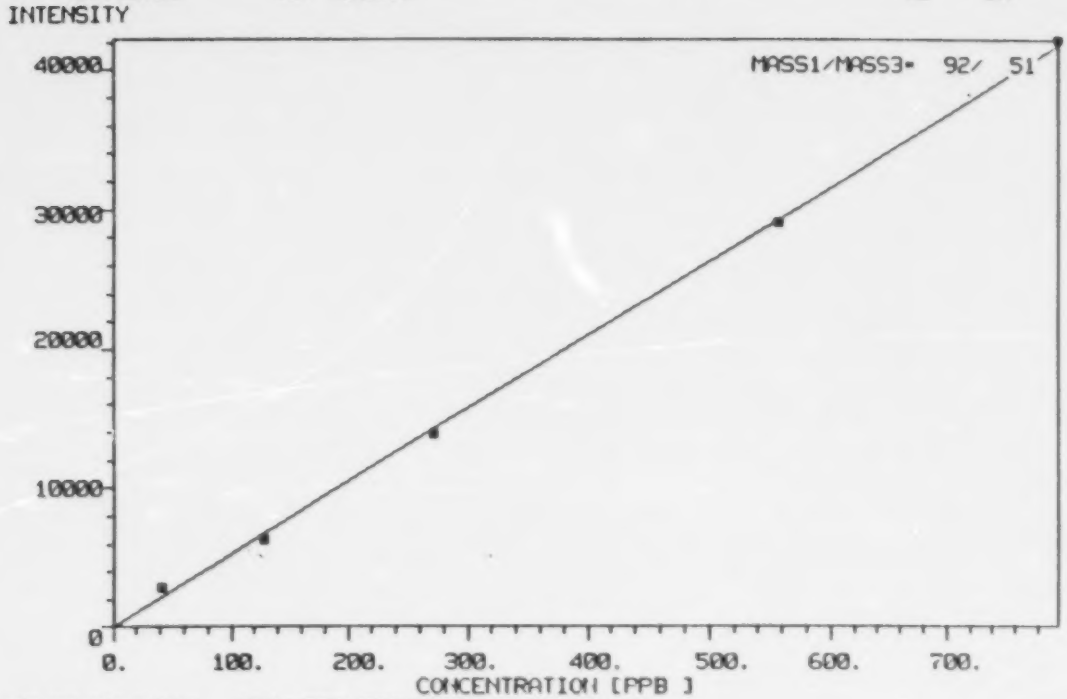


CALCULATED FIT - MEASURED POINTS AND LINEAR FIT
METHYL ETHYL KETONE CALIBRATION

LEAST SQUARES LINEAR REGRESSION RESULTS

MASS1/MASS3	N	SLOPE	INTERCEPT	R2
73.0/ 31.0	5.	70.21011	26639.49	0.9816
73.0/ 43.0	5.	54.40878	11717.90	0.9943

11-JUL-86 A1 5798.2 DI -1.0665 CG 301.95
09:13:05 A2 1788.9 VL ON



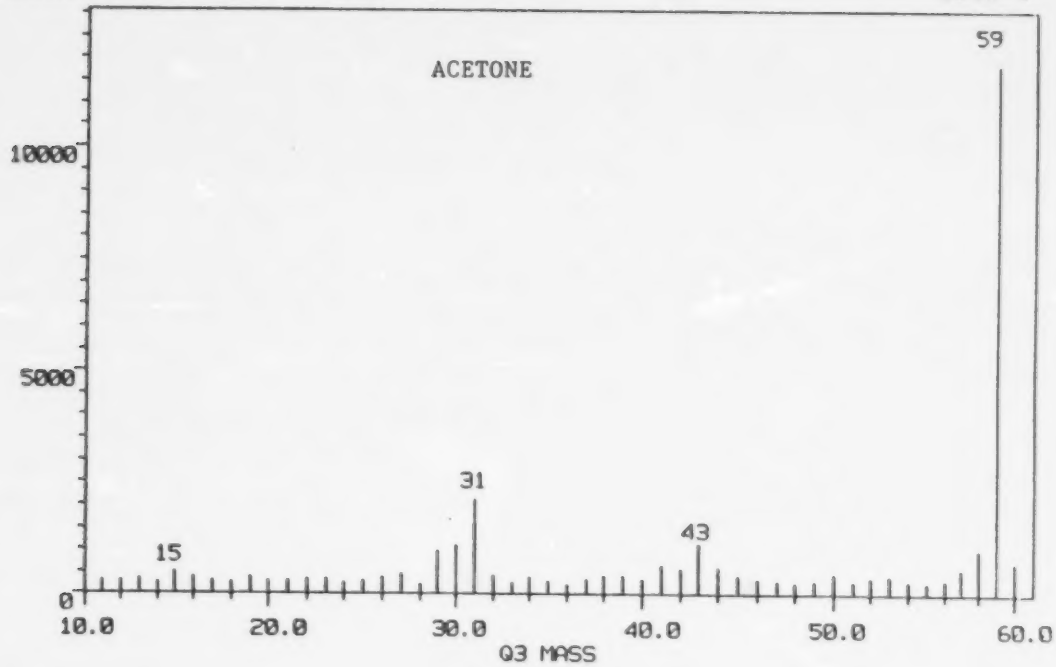
CALCULATED FIT - MEASURED POINTS AND LINEAR FIT
TOLUENE CALIBRATION

[illegible] SQUARES LINEAR REGRESSION RESULTS

MASS1/MASS3	N	SLOPE	INTERCEPT	R2
0/ 39.0	5.	30.69253	68.73071	0.9993
0/ 51.0	5.	52.50956	[illegible]	0.9995

CONFIRMING SPECTRA FOR
METEOROLOGICAL SITE

DAUGHTER ION SPECTRUM FOR MASS 59 SCAN: 1



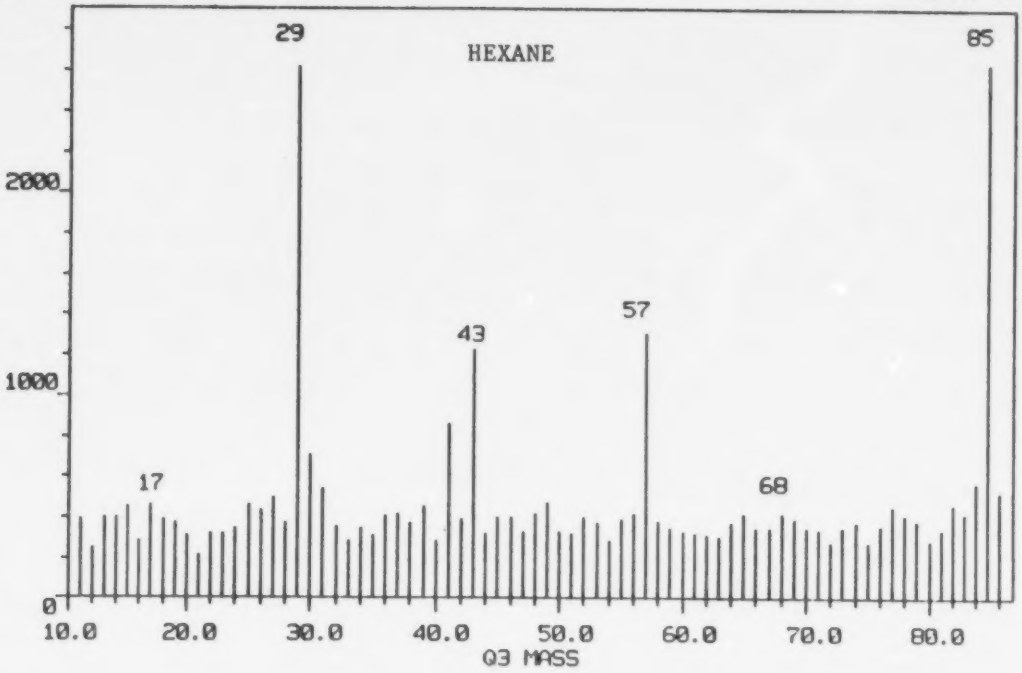
MET STATION SITE (WIND NORTH LESS 5 MPH)

LIBRARY SEARCH RESULTS

LIBRARY FILE: TAGA6000

NAME	FORMULA	INDEX	M.W.	RESULT
PROPIONALDEHYDE	C3.H6.O	193	58	0.7325
ACETONE	C3.H6.O	300	58	0.7166
ACETONE	C3.H6.O	189	58	0.6647
PROPYLENE OXIDE	C3H6O	53	58	0.6367
PROPIONALDEHYDE	C3.H6.O	309	58	0.5477
ACETONE	C3.H6.O	87	58	0.4851

DAUGHTER ION SPECTRUM FOR MASS 85 SCAN: 1



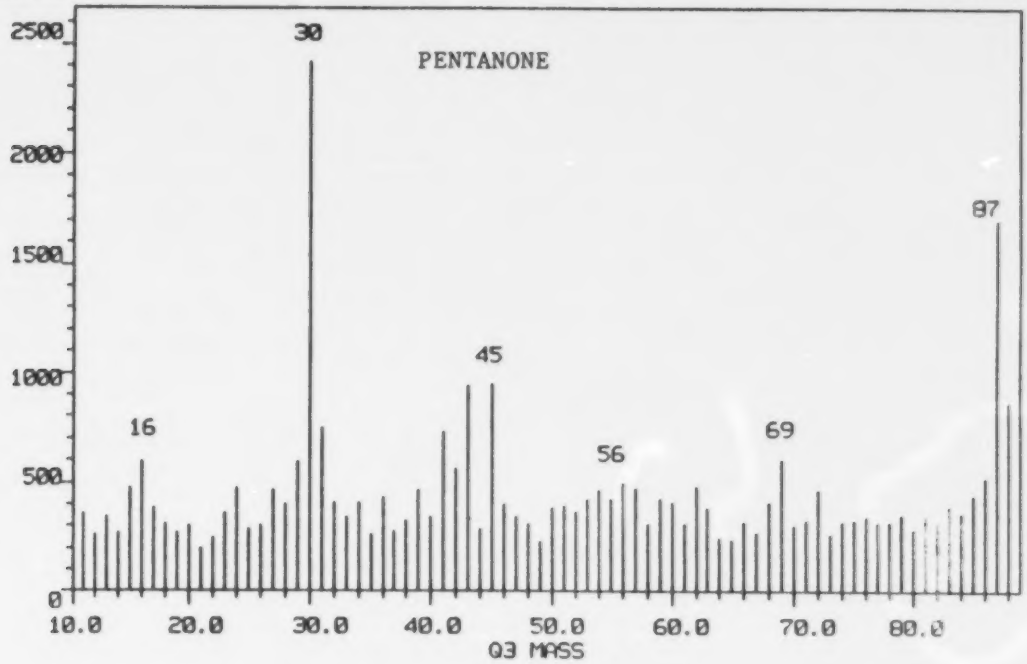
MET STATION SITE (WIND NORTH LESS 5 MPH)

LIBRARY SEARCH RESULTS

LIBRARY FILE: TAGA6000

NAME	FORMULA	INDEX	M.W.	RESULT
CHLOROFORM (85)	CHCL3	77	118	0.5121

DAUGHTER ION SPECTRUM FOR MASS 87 SCAN: 1



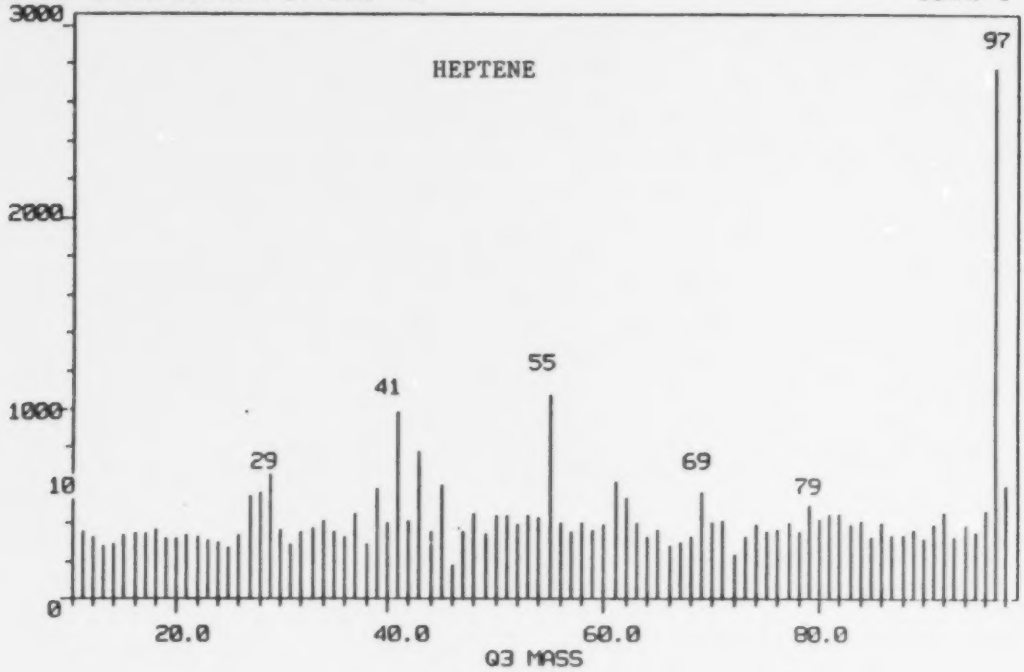
MET STATION SITE (WIND NORTH LESS 5 MPH)

LIBRARY SEARCH RESULTS

LIBRARY FILE: TAGA6000

NAME	FORMULA	INDEX	M.W.	RESULT

DAUGHTER ION SPECTRUM FOR MASS 97 SCAN: 1



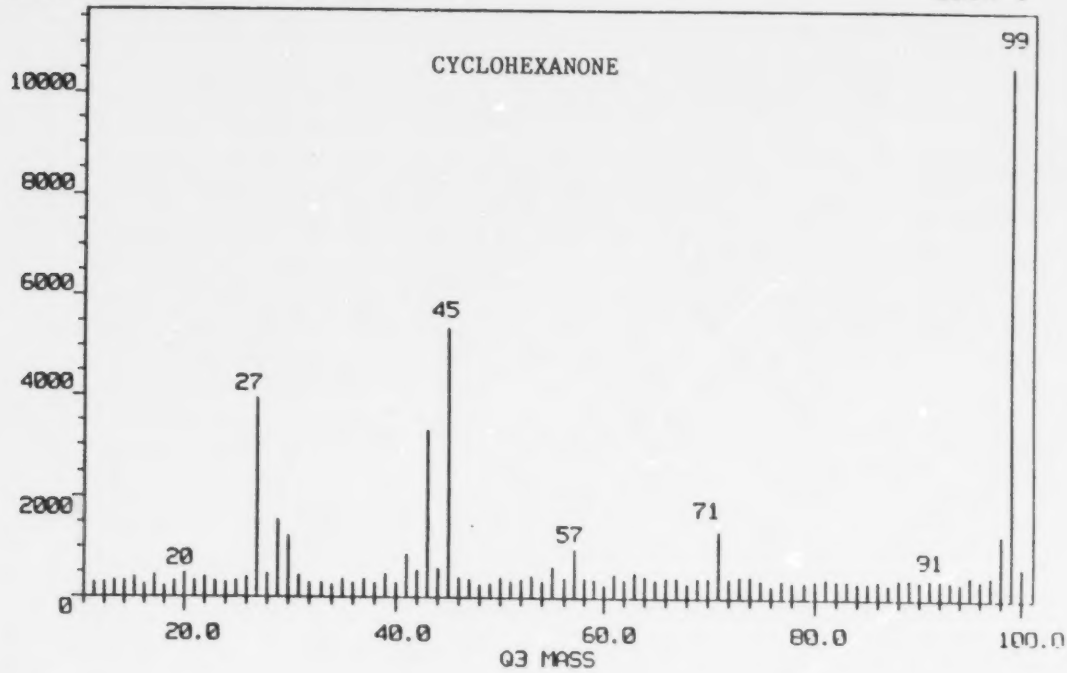
MET STATION SITE (WIND NORTH LESS 5 MPH)

LIBRARY SEARCH RESULTS

LIBRARY FILE: TAGA6000

NAME	FORMULA	INDEX	M.W.	RESULT
M/Z=97 FROM UFFI	?	144	96	0.9381
VINYLIDENE CHLORIDE	C2H3CL2	61	96	0.1925

DAUGHTER ION SPECTRUM FOR MASS 99 SCAN: 1



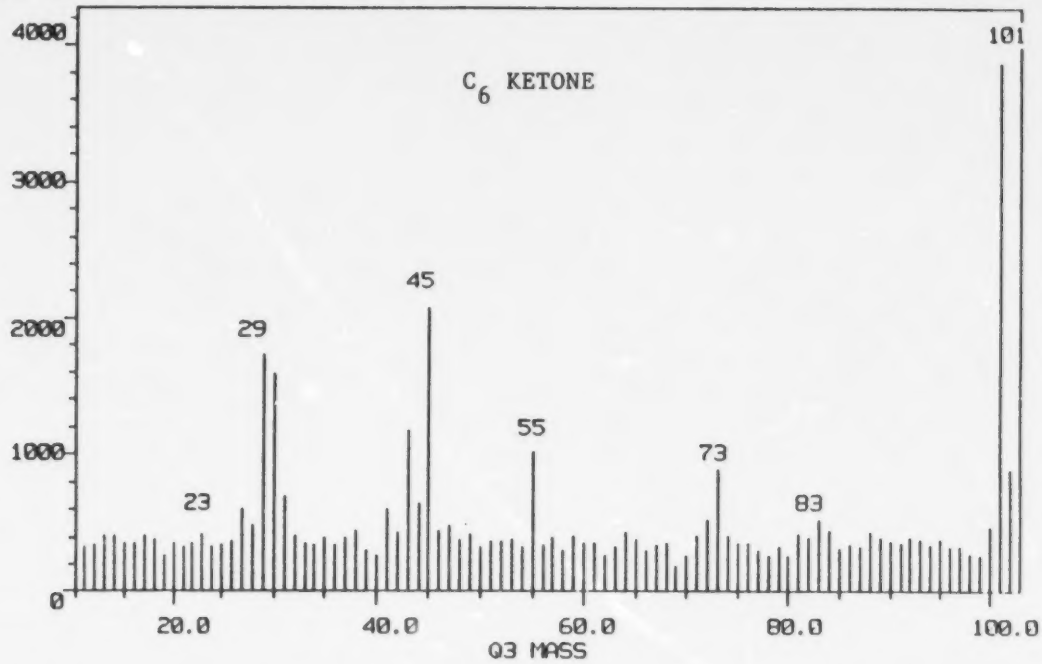
MET STATION SITE (WIND NORTH LESS 5 MPH)

LIBRARY SEARCH RESULTS

LIBRARY FILE: TAGA6000

NAME	FORMULA	INDEX	M.W.	RESULT
VINYLIDENE CHLORIDE	C2H3CL2	62	96	0.6980
METHYLCHLOROFORM	C2H3CL3	60	132	0.6729
CYCLOHEXANONE	C6.H10.O	301	98	0.4000

DAUGHTER ION SPECTRUM FOR MASS 101 SCAN: 1



MET STATION SITE (WIND NORTH LESS 5 MPH)

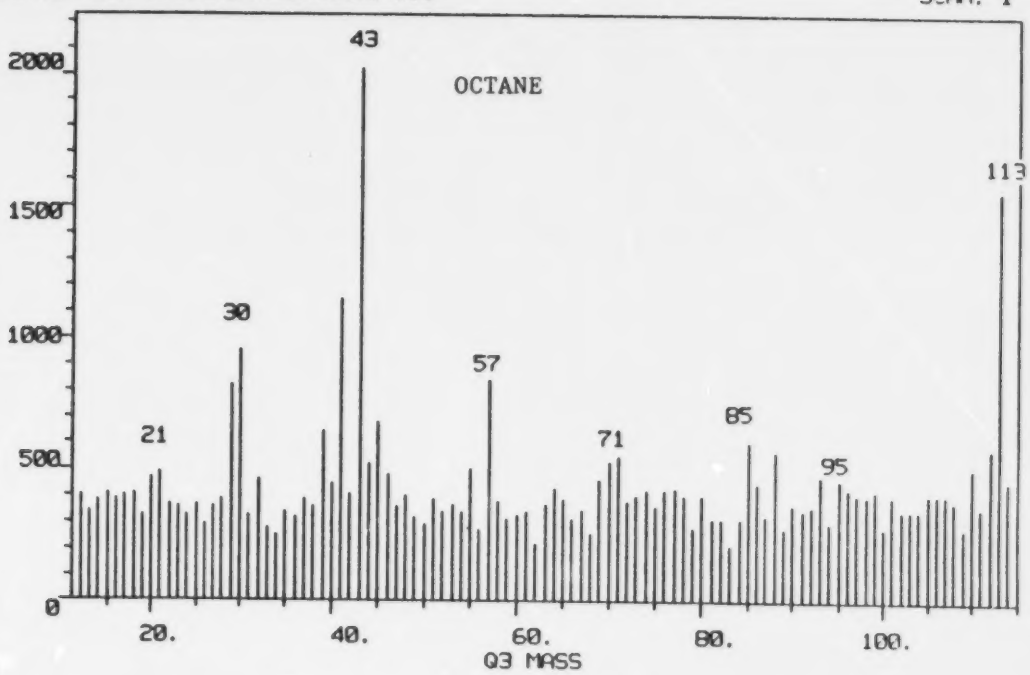
LIBRARY SEARCH RESULTS

LIBRARY FILE: TAGA6000

NAME	FORMULA	INDEX	M.W.	RESULT
METHYLISOBUTYL KETONE	C6.H12.O	164	100	0.6770
2-METHYL-4-PENTEN-2-OL	C6.H12.O	167	100	0.6770
2-METHYL-4-PENTEN-2-OL	C6.H12.O	15	100	0.6445
3-METHYL-1-VALERALDEHYDE	C6.H12.O	292	100	0.6004
2-METHYL-4-PENTEN-2-OL	C6.H12.O	277	100	0.5849
3-METHYL-1-VALERALDEHYDE	C6.H12.O	21	100	0.4773
3-METHYL-1-VALERALDEHYDE	C6.H12.O	173	100	0.4732
CYCLOHEXANOL	C6.H12.O	94	100	0.4588
4-METHYL-4-PENTEN-2-OL	C6.H12.O	16	100	0.4364
5-HEXEN-3-OL	C6.H12.O	171	100	0.4117

DAUGHTER ION SPECTRUM FOR MASS 113

SCAN: 1



MET STATION SITE (WIND NORTH LESS 5 MPH)

LIBRARY SEARCH RESULTS

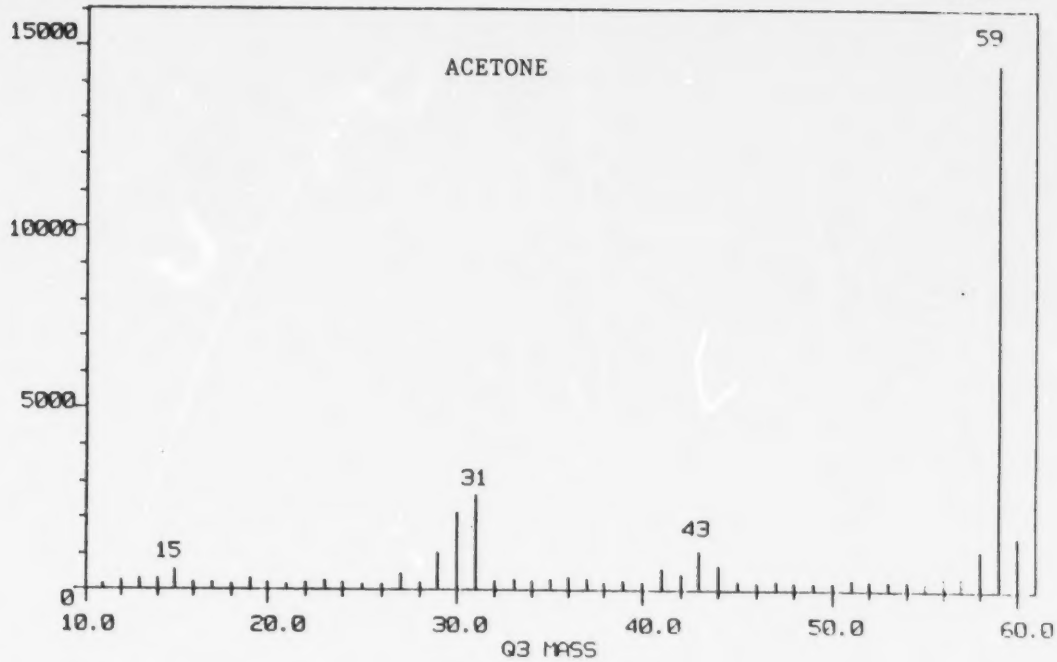
LIBRARY FILE: TAGA6000

NAME	FORMULA	INDEX	M.W.	RESULT

CONFIRMING SPECTRA FOR
SHRAM ROAD

DAUGHTER ION SPECTRUM FOR MASS 59

SCAN: 1



SCHRAM ROAD LOCATION (WIND <5MPH))

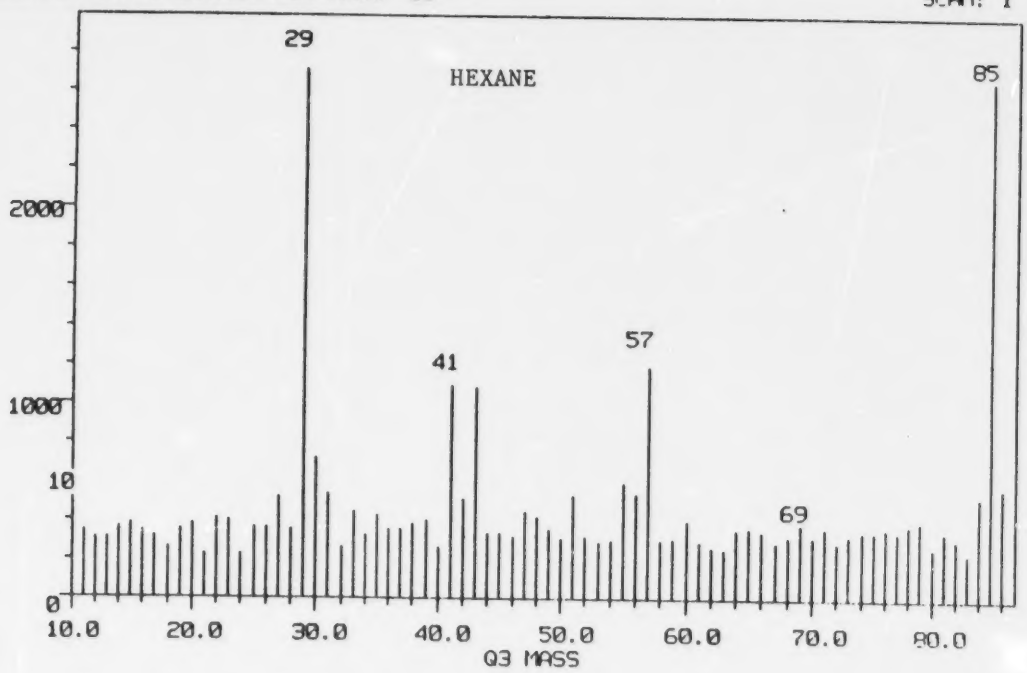
LIBRARY SEARCH RESULTS

LIBRARY FILE: TAGA6000

NAME	FORMULA	INDEX	M.W.	RESULT
PROPIONALDEHYDE	C3.H6.O	193	58	0.7809
PROPYLENE OXIDE	C3H6O	53	58	0.7531
ACETONE	C3.H6.O	300	58	0.7352
ACETONE	C3.H6.O	189	58	0.6988
PROPIONALDEHYDE	C3.H6.O	309	58	0.6325
ACETONE	C3.H6.O	87	58	0.5423
PROPIONALDEHYDE	C3.H6.O	91	58	0.2582

DAUGHTER ION SPECTRUM FOR MASS 85

SCAN: 1



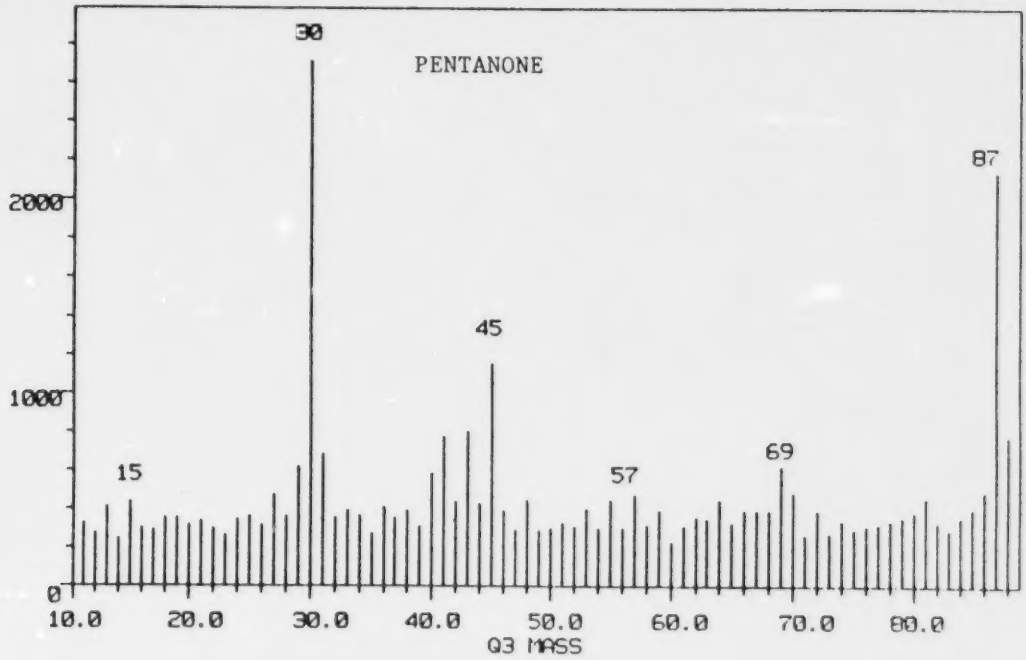
SCHRAM ROAD LOCATION (WIND <5MPH N)

LIBRARY SEARCH RESULTS

LIBRARY FILE: TAGA6000

NAME	FORMULA	INDEX	M.W.	RESULT
CHLOROFORM (85)	CHCL3	77	118	0.5121

DAUGHTER ION SPECTRUM FOR MASS 87 SCAN: 1



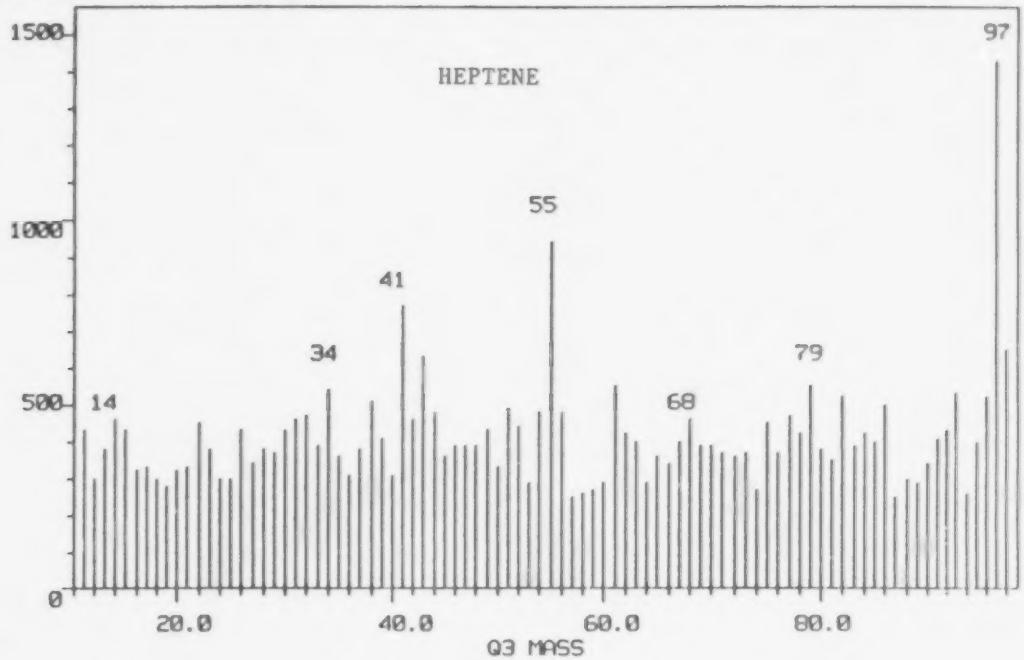
SCHRAM ROAD LOCATION (WIND <5MPH !!)

LIBRARY SEARCH RESULTS

LIBRARY FILE: TAGA6000

NAME	FORMULA	INDEX	M.W.	RESULT

DAUGHTER ION SPECTRUM FOR MASS 97 SCAN: 1



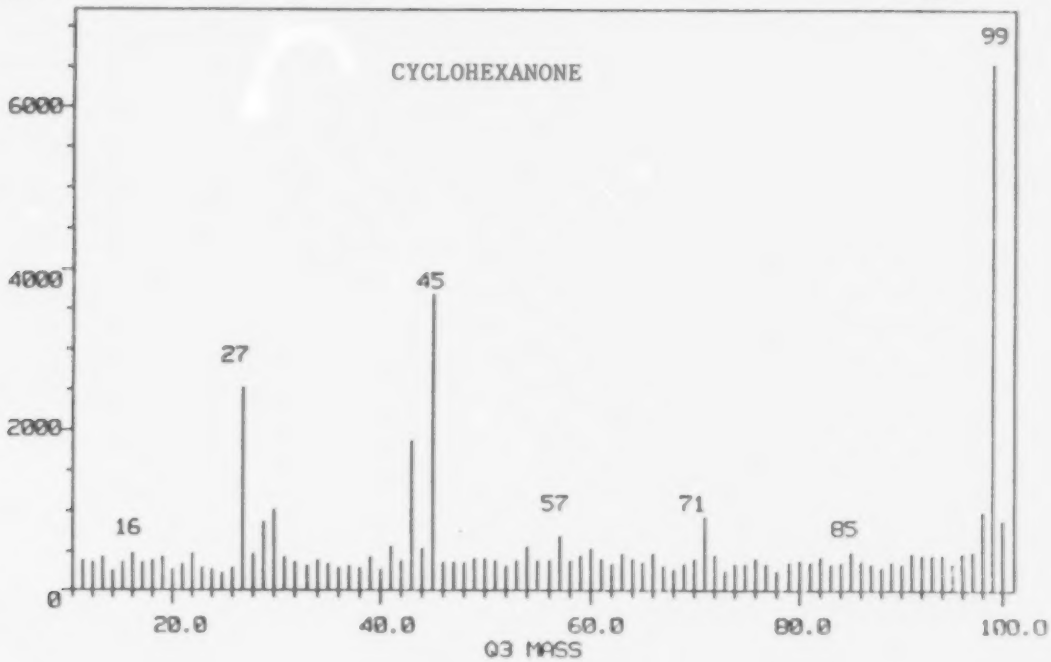
SCHRAM ROAD LOCATION (WIND <5MPH N)

LIBRARY SEARCH RESULTS

LIBRARY FILE: 1AGA6000

NAME	FORMULA	INDEX	M.W.	RESULT
M/Z=97 FROM UFFI	?	144	96	0.9798

DAUGHTER ION SPECTRUM FOR MASS 99 SCAN: 1



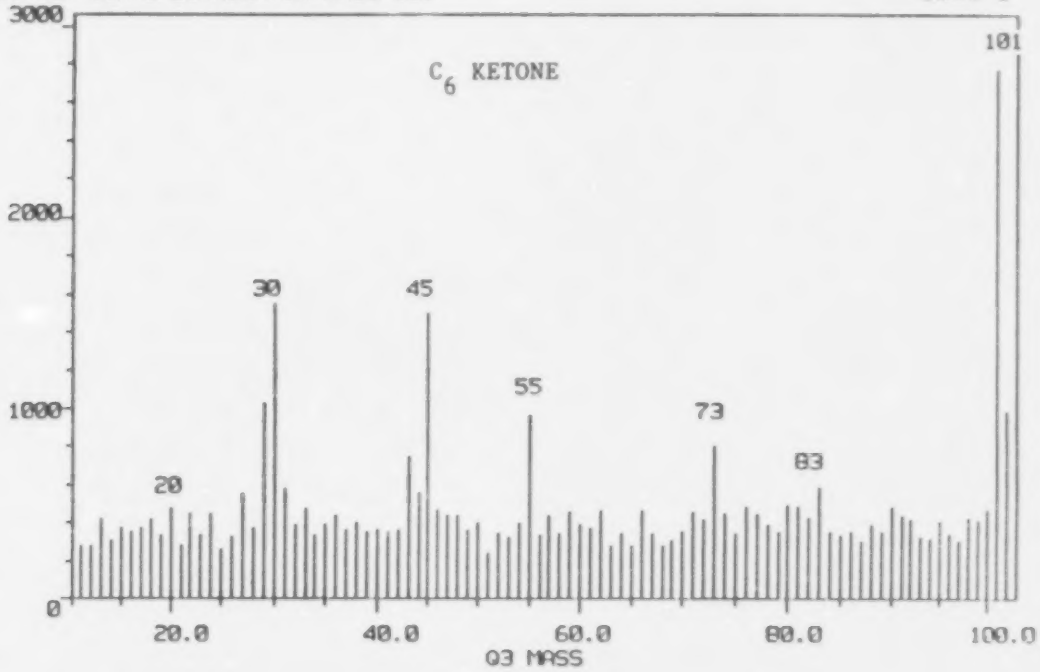
SCHRAM ROAD LOCATION (WIND <5MPH N)

LIBRARY SEARCH RESULTS

LIBRARY FILE: TAGA6300

NAME	FORMULA	INDEX	M.W.	RESULT
VINYLIDENE CHLORIDE	C2H3CL2	62	96	0.6602
METHYLCHLOROFORM	C2H3CL3	60	132	0.6295
CYCLOHEXANONE	C6.H10.O	301	98	0.3162

DAUGHTER ION SPECTRUM FOR MASS 101 SCAN: 1



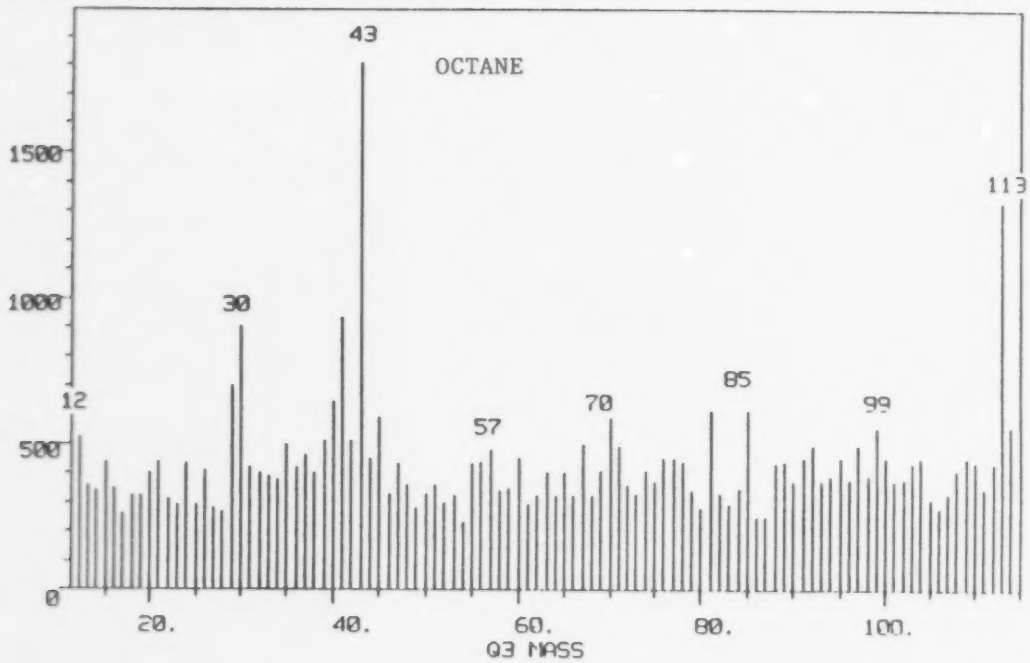
SCHRAM ROAD LOCATION (WIND <5MPH)

LIBRARY SEARCH RESULTS

LIBRARY FILE: TAGA6000

NAME	FORMULA	INDEX	M.W.	RESULT
METHYLISOBUTYL KETONE	C6.H12.O	164	100	0.6124
2-METHYL-4-PENTEN-2-OL	C6.H12.O	167	100	0.6124
CYCLOHEXANOL	C6.H12.O	94	100	0.3974
2-METHYL-4-PENTEN-2-OL	C6.H12.O	15	100	0.3922
3-METHYL-1-VALERALDEHYDE	C6.H12.O	292	100	0.3735
2-METHYL-4-PENTEN-2-OL	C6.H12.O	277	100	0.3441
3-METHYL-1-VALERALDEHYDE	C6.H12.O	173	100	0.2732
5-HEXEN-1-OL	C6.H12.O	169	100	0.2357
BUTYL VINYL ETHER	C6.H12.O	172	100	0.1826
4-METHYL-4-PENTEN-2-OL	C6.H12.O	16	100	0.1543

DAUGHTER ION SPECTRUM FOR MASS 113 SCAN: 1



SCHRAM ROAD LOCATION (WIND <5MPH ID

LIBRARY SEARCH RESULTS

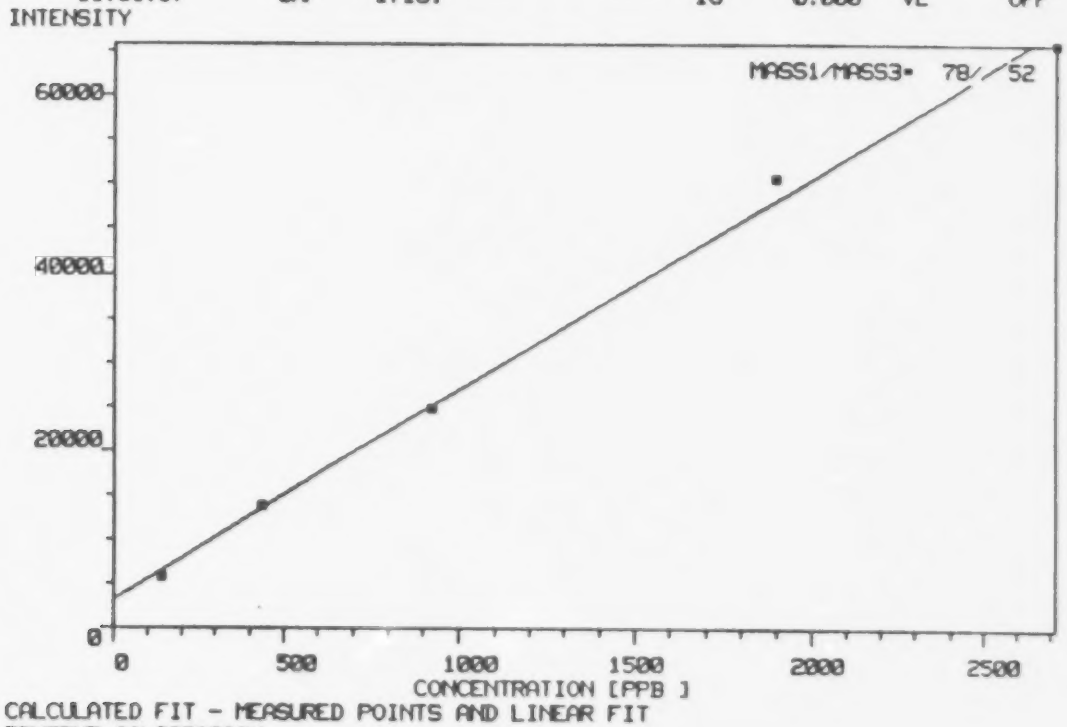
LIBRARY FILE: TAGA6000

NAME	FORMULA	INDEX	M.W.	RESULT

CALIBRATION CURVES

October 9, 1986

9-OCT-86 BAF 1914. DI -1.0 CG 56.
11:31:57 SAF 1718. IG 0.000 VL OFF

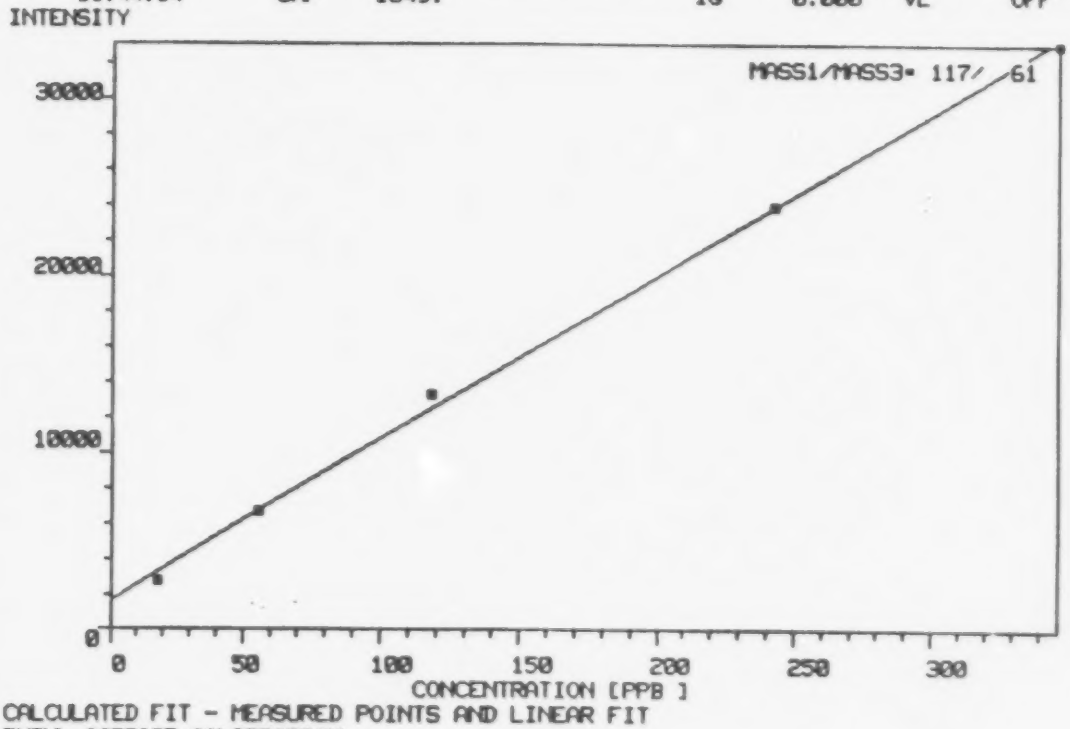


CALCULATED FIT - MEASURED POINTS AND LINEAR FIT
BENZENE CALIBRATION

LEAST SQUARES LINEAR REGRESSION RESULTS

MASS1/MASS3	N	SLOPE	INTERCEPT	R2
78.0/ 52.0	5.	23.64504	3294.508	0.9980
78.0/ 39.0	5.	13.93428	1721.227	0.9985

9-OCT-86 BAF 1935. DI -1.0 CG 58.
11:44:14 SAF 1649. IG 0.000 VL OFF



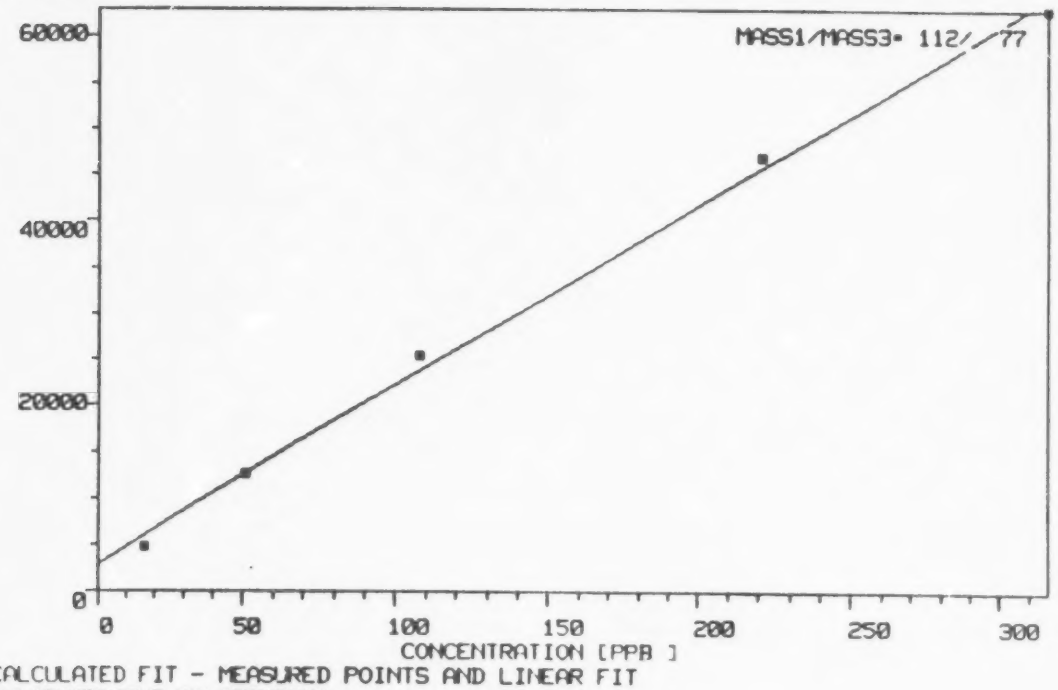
CALCULATED FIT - MEASURED POINTS AND LINEAR FIT
BUTYL ACETATE CALIBRATION

LEAST SQUARES LINEAR REGRESSION RESULTS

MASS1/MASS3	N	SLOPE	INTERCEPT	R2
117.0/ 61.0	5.	91.35506	1627.165	0.9990
117.0/ 57.0	5.	59.74766	862.7296	0.9996

9-OCT-86	BAF	1914.	DI	-1.0			CG	37.
12:13:02	SAF	1585.			IG	0.000	VL	OFF

INTENSITY



CALCULATED FIT - MEASURED POINTS AND LINEAR FIT
CHLOROBENZENE CALIBRATION

LEAST SQUARES LINEAR REGRESSION RESULTS

MASS1/MASS3	N	SLOPE	INTERCEPT	R2
112.0/ 77.0	5.	193.3477	2960.734	0.9984
112.0/ 51.0	5.	94.17231	1250.394	0.9992

9-OCT-86 BAF 1914. DI -1.0 CG 41.
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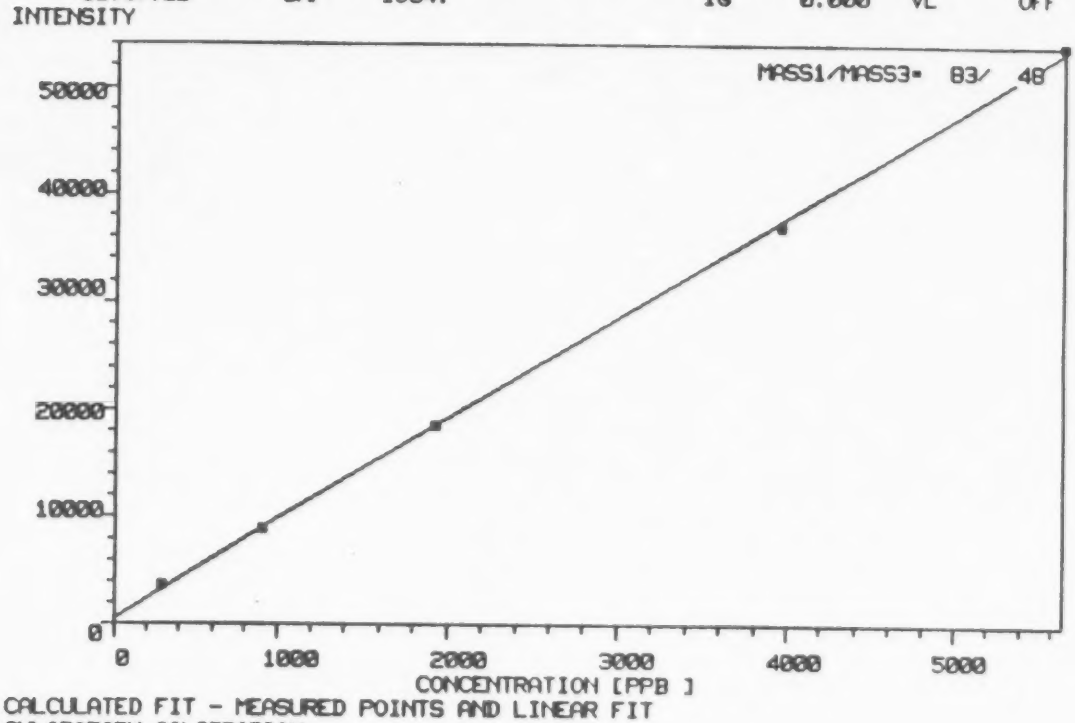

CALCULATED FIT - MEASURED POINTS AND LINEAR FIT
CHLOROFORM CALIBRATION

LEAST SQUARES LINEAR REGRESSION RESULTS

MASS1/MASS3	N	SLOPE	INTERCEPT	R2
83.0/ 48.0	5.	9.361861	523.4589	0.9998
85.0/ 50.0	5.	3.477386	260.9730	0.9994

9-OCT-86 BAF 1914. DI -1.0 CG 60.
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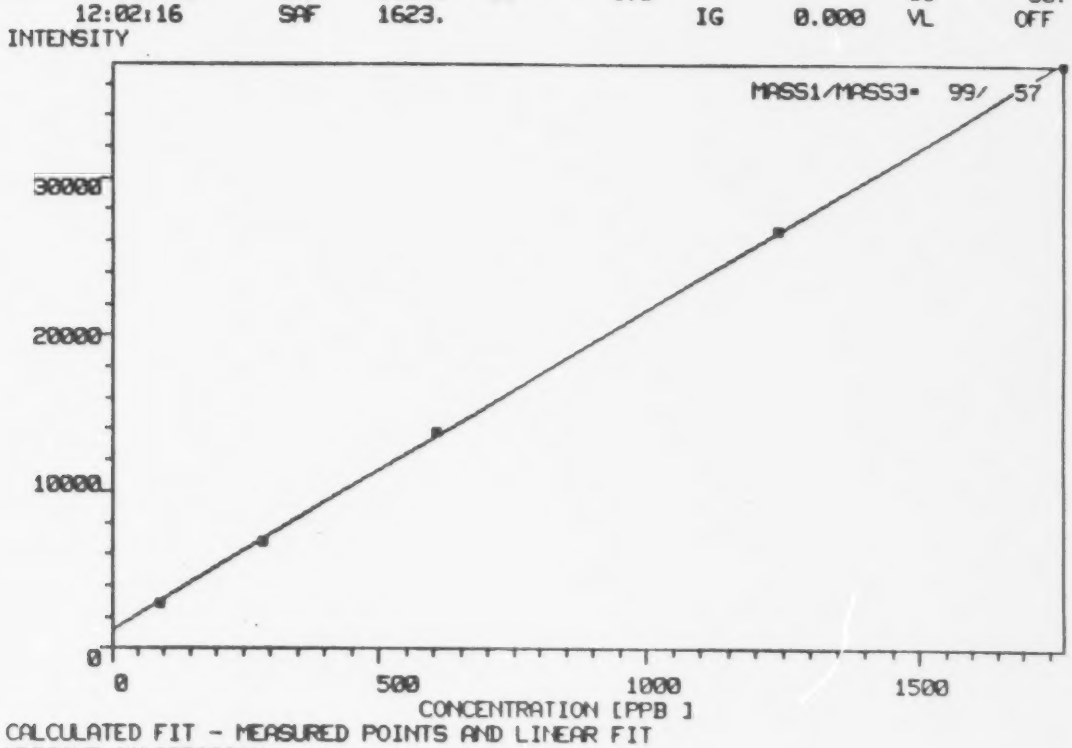
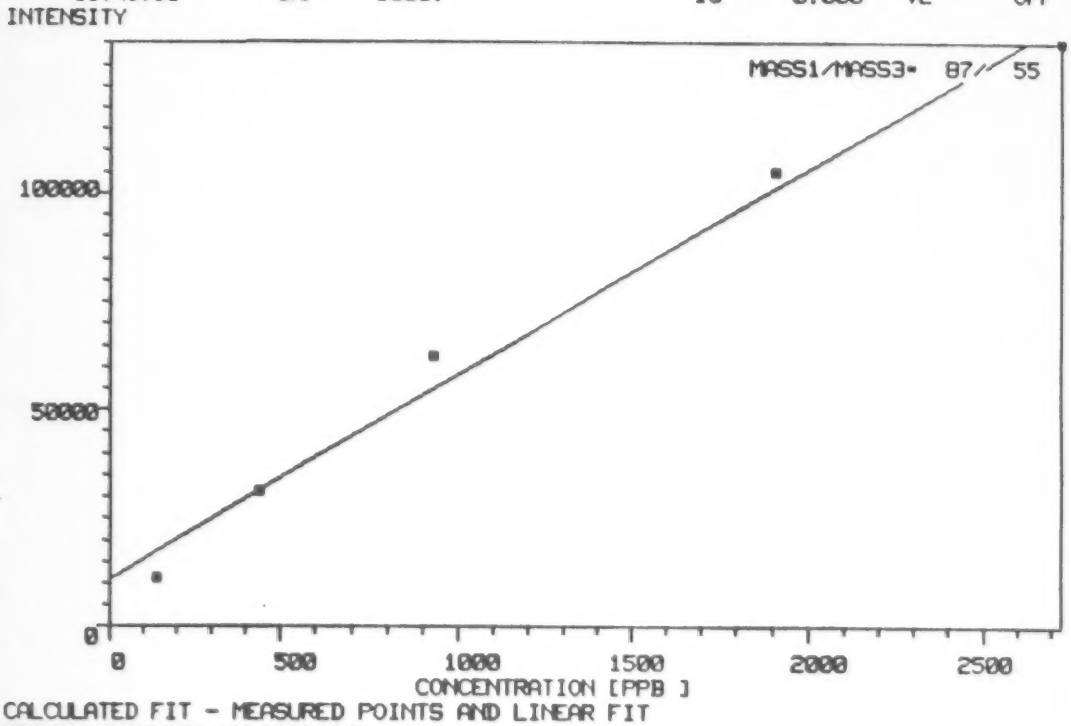


CALCULATED FIT - MEASURED POINTS AND LINEAR FIT
HEPTANE CALIBRATION

LEAST SQUARES LINEAR REGRESSION RESULTS

MASS1/MASS3	N	SLOPE	INTERCEPT	R2
99.0/ 43.0	5.	5.789694	939.0472	0.9998
99.0/ 57.0	5.	20.45395	1143.969	0.9998

9-OCT-86	BAF	1914.	DI	-1.0			CG	53.
11:49:51	SAF	1686.			IG	0.000	VL	OFF

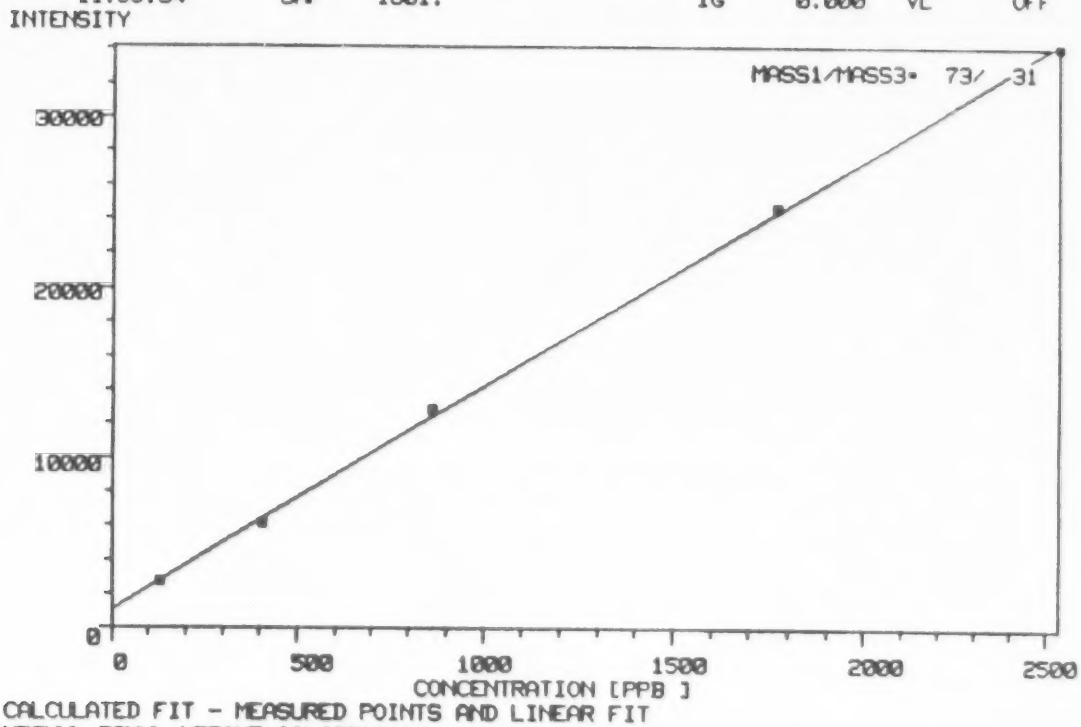


CALCULATED FIT - MEASURED POINTS AND LINEAR FIT
METHYL ACRYLATE CALIBRATION

LEAST SQUARES LINEAR REGRESSION RESULTS

MASS1/MASS3	N	SLOPE	INTERCEPT	R2
87.0/ 55.0	5.	47.25171	10908.48	0.9935
87.0/ 27.0	5.	5.028970	708.0186	0.9993

9-OCT-86	BAF	1914.	DI	-1.0			CG	34.
11:55:34	SAF	1601.			IG	0.000	VL	OFF

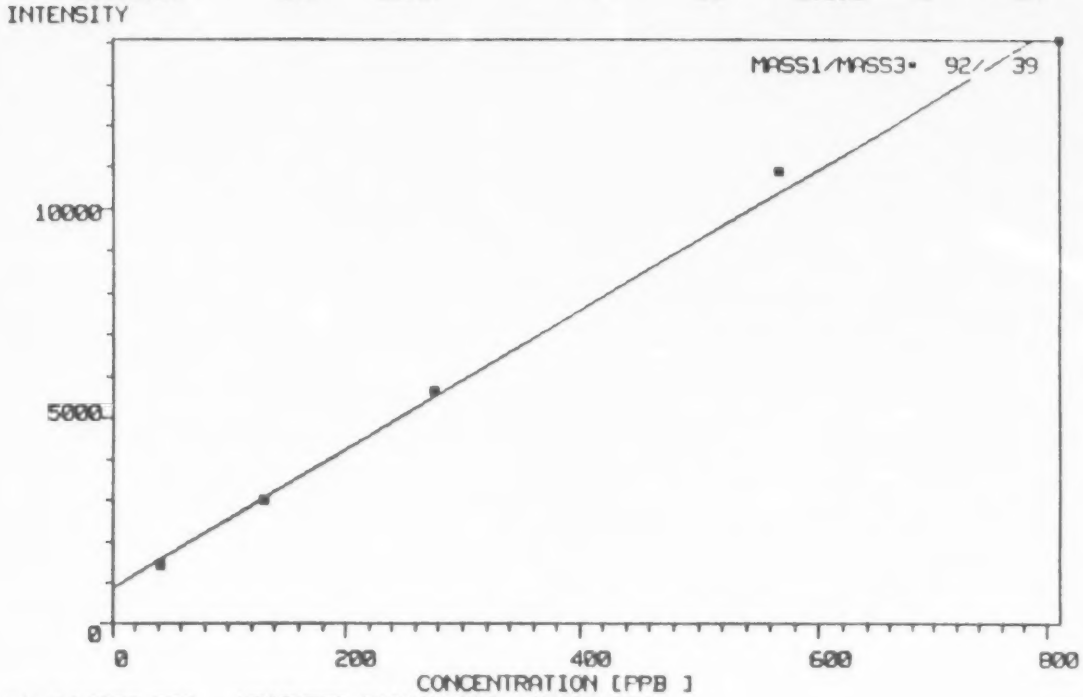


CALCULATED FIT - MEASURED POINTS AND LINEAR FIT
METHYL ETHYL KETONE CALIBRATION

LEAST SQUARES LINEAR REGRESSION RESULTS

MASS1/MASS3	N	SLOPE	INTERCEPT	R2
73.0/ 31.0	5.	13.10658	1120.688	0.9997
73.0/ 29.0	5.	9.401435	871.6485	0.9998

9-OCT-06 BAF 1914. DI -1.0 CG 48.
11:39:29 SAF 1691. IG 0.000 VL OFF



CALCULATED FIT - MEASURED POINTS AND LINEAR FIT
TOLUENE CALIBRATION

LEAST SQUARES LINEAR REGRESSION RESULTS

MASS1/MASS3	N	SLOPE	INTERCEPT	R2
92.0/ 39.0	5.	16.72180	891.8847	0.9979
92.0/ 51.0	5.	34.61835	1518.376	0.9973

Volume

4

Final report

OWMC
Ontario
Waste Management
Corporation

A provincial crown corporation.

ONTARIO RESEARCH
FOUNDATION

SITE ASSESSMENT
PHASE 4B:
ATMOSPHERIC CONDITIONS
VOLUME 4 - APPENDICES G to Q

Prepared for
The Ontario Waste Management Corporation

Submitted By

C.J. Baynes
M. Dobson
P. Piersol
A. Mijailovic
S.C. Barton

Ontario Research Foundation

October, 1987

APPENDIX G

SITE DISPERSION CLIMATE

G-1 INTRODUCTION

A site-specific dispersion climatology has been formulated for the OWMC preferred site, based on a synthesis of one year of "baseline" measurements made on-site with meteorological data from the St. Catharines and Mt. Hope airports (AES, 1987a and 1987b).

G-2 METHODOLOGY FOR SITE SPECIFIC CLIMATOLOGY

Wind roses for the three stations were compared and St. Catharines was determined to be the site best representing the long-term wind climate at the OWMC site. Wind speed and wind direction contingency tables for the period June 1986 - May 1987 were constructed as illustrated in Figures G-1 and G-2. Results are presented in Tables G-1 and G-2. The long-term probability of wind speed class I was then determined as:

$$p(I)_{site} = \sum_{i=1,m} p(i)_{St.Cath.} \times p\{(I)_{site} / (i)_{St.Cath.}\}$$

where $p(i)_{St.Cath.}$ is the long-term probability of wind speed i at St. Catharines and $p\{(I)_{site}/(i)_{St.\ Cath.}\}$ is the conditional probability of speed I at the site, given a speed i at St. Catharines. Note that the conditional probability is equivalent to $p(i)_{St.\ Cath.} \times p\ (I,i)$, the latter being the joint probability illustrated in Figure G-1.

The statistical analysis of the wind direction data was carried out in the same manner, i.e., the probability of wind direction J was calculated as:

$$p(J)_{site} = \sum_{J=1,n} p(j)_{St.Cath.} \times p\ \{(J)_{site}/(j)\ St.\ Cath.\}$$

Hourly wind speed and solar radiation measurements taken during the one year baseline study were used to assign stability classes based on the Pasquill typing scheme (Turner, 1970). Table G-3 gives the original Pasquill stability typing scheme. Table G-4 summarizes the method used to assign Pasquill stability classes using the baseline data. The one year of hourly data generated was compared to the corresponding hourly stability data obtained from the St. Catharines and Mt. Hope airports. This comparison indicated that the Mt. Hope stability data most closely correlated with the site data. However, due to uncertainties in the estimation of the Pasquill stability classes based on solar radiation, the long-term stability class frequency data from Mt. Hope was used unaltered to represent site conditions (see Table G-5).

The synthesized STability ARray (STAR) obtained from the above analysis is given in Table G-6.

The same analysis was undertaken for the summer months (May, June and July). Tables G-7 and G-8 give the wind speed and direction contingency tables used to derive the synthesized STAR data set in this case. Table G-9 presents the Mt. Hope stability class frequencies for the summer months. The synthesized STAR (summer only) is given in Table G-10.

G-3 REFERENCES

AES (Atmospheric Environment Service), 1987a, "Monthly Meteorological Summaries" - St. Catharines and Mt. Hope for June 1986 to May 1987, inclusive.

AES (Atmospheric Environment Service), 1987b, "STAR Analyses for 1977 to 1986" provided for Mt. Hope and St. Catharines.

Turner, B.D., 1970, "Workbook of Atmospheric Dispersion Estimates", U.S. Dept. of Health, Education and Welfare, PB-191 482.

TABLE G-1

Joint Frequency of Occurrence of
Wind Speed at St. Catharines
and the OWMC Site during the Baseline Study

		OWMC Site					
Wind Speed (km/h)		0-6	7-13	14-20	21-30	31-40	>40
St. Catharines	0-6	.1332	.0325	.0011	.0011	.0001	.0001
	7-13	.1992	.1474	.0147	.0008	.0001	.0000
	14-20	.0345	.1491	.0586	.0058	.0001	.0000
	21-30	.0024	.0392	.0924	.0433	.0019	.0000
	31-40	.0000	.0005	.0058	.0196	.0044	.0000
	>40	.0000	.0001	.0006	.0057	.0038	.0000

TABLE G-2

Joint Frequency of Occurrence of Wind Direction at
St. Catharines and the OWMC Site
During the Baseline Study

	OWMC Site															
Degrees	0	22.5	45	67.5	90	112.5	135	157.5	180	202.5	225	247.5	270	292.5	315	337.5
0	.0222	.0076	.0050	.0012	.0006	.0010	.0013	.0011	.0002	.0018	.0027	.0013	.0007	.0019	.0030	.0027
22.5	.0116	.0127	.0085	.0018	.0013	.0001	.0002	.0000	.0008	.0008	.0006	.0002	.0002	.0004	.0001	.0001
45	.0066	.0191	.0196	.0018	.0011	.0008	.0006	.0008	.0006	.0007	.0006	.0002	.0002	.0004	.0001	.0001
67.5	.0023	.0131	.0231	.0054	.0008	.0004	.0007	.0007	.0001	.0010	.0007	.0007	.0000	.0001	.0000	.0002
90	.0018	.0064	.0196	.0258	.0129	.0050	.0029	.0011	.0008	.0008	.0011	.0006	.0002	.0000	.0001	.0000
112.5	.0001	.0010	.0028	.0031	.0058	.0050	.0017	.0007	.0001	.0006	.0007	.0007	.0000	.0000	.0000	.0000
135	.0004	.0000	.0010	.0012	.0011	.0031	.0037	.0023	.0006	.0004	.0000	.0001	.0000	.0000	.0000	.0000
157.5	.0001	.0000	.0001	.0002	.0006	.0017	.0037	.0045	.0031	.0013	.0013	.0004	.0001	.0000	.0000	.0000
180	.0006	.0004	.0011	.0002	.0012	.0022	.0082	.0138	.0195	.0131	.0062	.0021	.0004	.0001	.0001	.0002
202.5	.0008	.0001	.0000	.0001	.0001	.0001	.0031	.0027	.0070	.0215	.0062	.0042	.0019	.0008	.0002	.0000
225	.0011	.0004	.0004	.0002	.0002	.0000	.0010	.0016	.0045	.0244	.0932	.0374	.0087	.0010	.0006	.0000
247.5	.0007	.0002	.0010	.0001	.0001	.0000	.0004	.0001	.0016	.0028	.0172	.0528	.0215	.0206	.0006	.0006
270	.0033	.0002	.0000	.0000	.0000	.0002	.0001	.0002	.0013	.0028	.0080	.0212	.0407	.0157	.0050	.0012
292.5	.0047	.0001	.0002	.0000	.0001	.0001	.0002	.0001	.0010	.0017	.0033	.0068	.0129	.0203	.0088	.0029
315	.0105	.0011	.0011	.0002	.0002	.0004	.0001	.0004	.0006	.0016	.0056	.0031	.0085	.0097	.0104	.0058
337.5	.0154	.0030	.0008	.0002	.0002	.0000	.0004	.0006	.0002	.0006	.0023	.0010	.0028	.0028	.0028	.0045

TABLE G-3

Key to Stability Categories

Surface Wind Speed (at 10 m) (km/h)	Day: Incoming Solar Radiation: Strong	Day: Incoming Solar Radiation: Moderate	Day: Incoming Solar Radiation: Slight	Night: Thinly Overcast or ≥4/8 Low Cloud	Night: ≤3/8 Cloud
<7.2	A	A-B	B		
7.2-10.8	A-B	B	C	E	F
10.8-18.0	B	B-C	C	D	D
18.0-21.6	C	C-D	D	D	D
>21.6	C	D	D	D	D

The neutral class, D, should be assumed for overcast conditions during day or night.

(Turner, 1970)

TABLE G-4

Assignment of Pasquill Stability Class Based on Wind Speed and Solar Radiation

Pasquill Stability Class	Wind Speed (km/h)	Solar Radiation (W/m^2)
A	<7	>750
	7-10	>900
B	<7	1-750
	7-10	500-900
	11-17	>650
C	7-10	1-499
	11-17	1-650
	18-22	>750
	>22	>800
D	18-22	1-750
	>22	1-800
	>10	0
E	7-10	0
F	<7	0

TABLE G-5

Annual Frequency of Occurrence
of Pasquill Stability Classes
at Mt. Hope (1977-1986)

Stability Class	Relative Frequency of Occurrence (%)
A	0.9
B	5.7
C	13.3
D	66.5
E	7.3
F	6.3

TABLE G-6

Annual Synthesized Site STAR

Direction	0-6	7-13	Wind Speed (km/h) 14-20	21-30	31-40	>40
A STABILITY						
N	.001709	.001342	0.0	0.0	0.0	0.0
NNE	.000428	.000399	0.0	0.0	0.0	0.0
NE	.000151	.000132	0.0	0.0	0.0	0.0
ENE	.000043	.000016	0.0	0.0	0.0	0.0
E	.000108	.000024	0.0	0.0	0.0	0.0
ESE	0	0	0.0	0.0	0.0	0.0
SE	.000097	0	0.0	0.0	0.0	0.0
SSE	.000044	.000067	0.0	0.0	0.0	0.0
S	.000082	.000050	0.0	0.0	0.0	0.0
SSW	.000109	.000111	0.0	0.0	0.0	0.0
SW	.000250	.000180	0.0	0.0	0.0	0.0
WSW	.000341	.000131	0.0	0.0	0.0	0.0
W	.000508	.000349	0.0	0.0	0.0	0.0
WNW	.000414	.000397	0.0	0.0	0.0	0.0
NW	.000295	.000313	0.0	0.0	0.0	0.0
NNW	.000409	.000458	0.0	0.0	0.0	0.0
B STABILITY						
N	.005034	.007552	.002156	0.0	0.0	0.0
NNE	.002374	.002820	.000961	0.0	0.0	0.0
NE	.001415	.001809	.000632	0.0	0.0	0.0
ENE	.000766	.000628	.000110	0.0	0.0	0.0
E	.000551	.000206	.000044	0.0	0.0	0.0
ESE	.000668	.000355	.000080	0.0	0.0	0.0
SE	.001007	.000456	.000059	0.0	0.0	0.0
SSE	.001120	.000474	.000105	0.0	0.0	0.0
S	.001200	.000709	.000170	0.0	0.0	0.0
SSW	.001078	.000715	.000382	0.0	0.0	0.0
SW	.001516	.001042	.000475	0.0	0.0	0.0
WSW	.001395	.001167	.000375	0.0	0.0	0.0
W	.001973	.001792	.000701	0.0	0.0	0.0
WNW	.001652	.002263	.000743	0.0	0.0	0.0
NW	.001122	.001586	.000686	0.0	0.0	0.0
NNW	.001062	.001555	.000398	0.0	0.0	0.0

TABLE G-6 (cont'd)

Annual Synthesized Site STAR

Direction	0-6	7-13	Wind Speed (km/h 14-20	21-30	31-40	>40
C STABILITY						
N	.003654	.006885	.007764	.000317	0	0.0
NNE	.002258	.004842	.005560	.000783	0	0.0
NE	.002409	.003536	.004921	.000767	.000010	0.0
ENE	.000800	.001459	.001214	.000111	.000009	0.0
E	.000542	.000784	.000661	.000007	0	0.0
ESE	.001000	.001090	.000736	.000016	0	0.0
SE	.001509	.002215	.001410	0	0	0.0
SSE	.001647	.001486	.001527	.000092	0	0.0
S	.002153	.002533	.002287	.000171	.000014	0.0
SSW	.001646	.002460	.003681	.001004	.000110	0.0
SW	.002617	.003699	.005745	.001729	.000210	0.0
WSW	.002562	.004379	.004010	.000545	.000051	0.0
W	.002535	.004350	.005258	.000934	.000064	0.0
WNW	.001133	.002354	.003666	.000741	.000027	0.0
NW	.000863	.001863	.002230	.000254	.000004	0.0
NNW	.000846	.001388	.001238	.000112	.000005	0.0
D STABILITY						
N	.009150	.020015	.013888	.007012	.000531	0.0
NNE	.006248	.014134	.010853	.006269	.000284	0.0
NE	.006383	.018031	.015891	.012680	.000826	0.0
ENE	.003937	.008352	.008976	.005652	.001123	0.0
E	.002643	.007065	.006634	.003840	.000473	0.0
ESE	.004471	.007872	.004339	.001554	.000087	0.0
SE	.004556	.012937	.006757	.001432	.000185	0.0
SSE	.005082	.011288	.007144	.003896	.000443	0.0
S	.003849	.010589	.010749	.006660	.001122	0.0
SSW	.003721	.012143	.014557	.019192	.003198	0.0
SW	.004827	.017267	.024837	.037970	.010087	0.0
WSW	.005214	.016056	.023295	.032456	.007892	0.0
W	.005473	.014246	.017379	.024041	.004685	0.0
WNW	.003751	.008576	.010079	.011538	.002248	0.0
NW	.002295	.005989	.005613	.006052	.000915	0.0
NNW	.001715	.004548	.003446	.002972	.000314	0.0

TABLE G-6 (cont'd)

Annual Synthesized Site STAR

Direction	Wind Speed (km/h) 0-6	7-13	14-20	21-30	31-40	>40
E STABILITY						
N	0.0	.003251	.000545	0.0	0.0	0.0
NNE	0.0	.002498	.000591	0.0	0.0	0.0
NE	0.0	.002907	.000489	0.0	0.0	0.0
ENE	0.0	.001934	.000433	0.0	0.0	0.0
E	0.0	.002285	.000351	0.0	0.0	0.0
ESE	0.0	.003403	.000121	0.0	0.0	0.0
SE	0.0	.005877	.000583	0.0	0.0	0.0
SSE	0.0	.006639	.000489	0.0	0.0	0.0
S	0.0	.005446	.001380	0.0	0.0	0.0
SSW	0.0	.003708	.001370	0.0	0.0	0.0
SW	0.0	.007769	.005279	0.0	0.0	0.0
WSW	0.0	.005417	.003885	0.0	0.0	0.0
W	0.0	.001929	.000608	0.0	0.0	0.0
WNW	0.0	.001191	.000704	0.0	0.0	0.0
NW	0.0	.000726	.000516	0.0	0.0	0.0
NNW	0.0	.000293	.000249	0.0	0.0	0.0
F STABILITY						
N	.001892	.001094	.00	0.0	0.0	0.0
NNE	.001900	.000923	.00	0.0	0.0	0.0
NE	.003557	.001076	.00	0.0	0.0	0.0
ENE	.000900	.000584	.00	0.0	0.0	0.0
E	.001612	.000541	.00	0.0	0.0	0.0
ESE	.002470	.000938	.00	0.0	0.0	0.0
SE	.005410	.001771	.00	0.0	0.0	0.0
SSE	.002445	.000714	.00	0.0	0.0	0.0
S	.004361	.002441	.00	0.0	0.0	0.0
SSW	.004196	.001989	.00	0.0	0.0	0.0
SW	.005418	.004207	.00	0.0	0.0	0.0
WSW	.004481	.002444	.00	0.0	0.0	0.0
W	.001689	.000736	.00	0.0	0.0	0.0
WNW	.001310	.000398	.00	0.0	0.0	0.0
NW	.000377	.000499	.00	0.0	0.0	0.0
NNW	.000481	.000168	.00	0.0	0.0	0.0

TABLE G-7

Joint Frequency of Occurrence of Wind Speed
at St. Catharines and the OWMC Site
During the Summer Months of the Baseline Study

	OWMC Site					
Wind Speed (km/h)	0.6	7-13	14-20	21-30	31-40	>40
0-6	.1508	.0283	.0027	.0041	.0005	.0005
7-13	.2651	.1293	.0105	.0005	.0005	.0000
14-20	.0558	.0169	.0361	.0050	.0000	.0000
21-30	.0009	.0439	.0772	.0215	.0005	.0000
31-40	.0000	.0000	.0023	.0050	.0000	.0000
>40	.0000	.0005	.0009	.0009	.0027	.0000

TABLE G-8

Joint Frequency of Occurrence of Wind Direction at
St. Catharines and the OWMC Site During the
Summer Months of the Baseline Study

	OWMC Site															
Degrees	0	22.5	45	67.5	90	112.5	135	157.5	180	202.5	225	247.5	270	292.5	315	337.5
0	.0151	.0042	.0010	.0005	.0005	.0026	.0000	.0005	.0026	.0037	.0042	.0010	.0026	.0026	.0052	.0010
22.5	.0126	.0094	.0058	.0016	.0000	.0000	.0005	.0000	.0016	.0005	.0010	.0000	.0000	.0000	.0010	.0005
45	.0089	.0136	.0073	.0016	.0031	.0010	.0010	.0016	.0016	.0005	.0010	.0000	.0005	.0010	.0000	.0000
67.5	.0042	.0073	.0183	.0037	.0000	.0000	.0005	.0016	.0005	.0016	.0010	.0005	.0000	.0000	.0000	.0005
90	.0026	.0058	.0152	.0099	.0042	.0031	.0005	.0010	.0005	.0010	.0010	.0005	.0000	.0000	.0000	.0000
112.5	.0000	.0005	.0042	.0010	.0005	.0037	.0005	.0000	.0000	.0016	.0010	.0000	.0000	.0000	.0000	.0000
135	.0005	.0000	.0005	.0000	.0026	.0000	.0037	.0000	.0005	.0016	.0000	.0000	.0000	.0000	.0000	.0000
157.5	.0005	.0000	.0000	.0005	.0000	.0000	.0037	.0047	.0005	.0031	.0026	.0005	.0005	.0000	.0000	.0000
180	.0000	.0000	.0016	.0005	.0010	.0016	.0141	.0256	.0319	.0220	.0136	.0058	.0010	.0005	.0005	.0005
202.5	.0000	.0000	.0000	.0005	.0000	.0000	.0016	.0016	.0115	.0235	.0476	.0084	.0037	.0026	.0000	.0000
225	.0010	.0000	.0000	.0005	.0010	.0000	.0010	.0005	.0016	.0183	.0988	.0382	.0094	.0031	.0005	.0000
247.5	.0010	.0000	.0005	.0000	.0000	.0000	.0010	.0000	.0010	.0010	.0167	.0109	.0084	.0031	.0016	.0005
270	.0037	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0010	.0016	.0167	.0162	.0382	.0293	.0141	.0010
292.5	.0115	.0000	.0000	.0000	.0005	.0005	.0000	.0000	.0016	.0010	.0058	.0837	.0110	.0204	.0199	.0078
315	.0115	.0005	.0010	.0000	.0000	.0000	.0000	.0000	.0000	.0031	.0042	.0010	.0052	.0058	.0084	.0099
337.5	.0173	.0010	.0005	.0000	.0000	.0000	.0000	.0000	.0005	.0010	.0052	.0005	.0026	.0010	.0047	.0037

TABLE G-9

Frequency of Occurrence of Pasquill Stability Classes at Mount Hope During the Summer Months (1977-1986)

Stability Class	Relative Frequency of Occurrence (%)
A	2.4
B	12.8
C	24.6
D	46.7
E	6.2
F	7.3

TABLE G-10

Summer Synthesized Site STAR

Direction	Wind Speed (km/h) 0-6	7-13	14-20	21-30	31-40	>40
A STABILITY						
N	.004783	.003616	0.0	0.0	0.0	0.0
NNE	.000641	.000597	0.0	0.0	0.0	0.0
NE	.000240	.000088	0.0	0.0	0.0	0.0
ENE	.000122	.000045	0.0	0.0	0.0	0.0
E	.000411	.000068	0.0	0.0	0.0	0.0
ESE	0	0	0.0	0.0	0.0	0.0
SE	0	0	0.0	0.0	0.0	0.0
SSE	.000072	.000138	0.0	0.0	0.0	0.0
S	.000305	.000189	0.0	0.0	0.0	0.0
SSW	.000248	.000231	0.0	0.0	0.0	0.0
SW	.000685	.000423	0.0	0.0	0.0	0.0
WSW	.001402	.000429	0.0	0.0	0.0	0.0
W	.001109	.000303	0.0	0.0	0.0	0.0
WNW	.001116	.001183	0.0	0.0	0.0	0.0
NW	.001342	.001422	0.0	0.0	0.0	0.0
NNW	.001160	.001533	0.0	0.0	0.0	0.0
B STABILITY						
N	.011193	.015465	.004279	0.0	0.0	0.0
NNE	.002870	.004316	.001368	0.0	0.0	0.0
NE	.001657	.002778	.000931	0.0	0.0	0.0
ENE	.000777	.001049	.000175	0.0	0.0	0.0
E	.001171	.000452	.000107	0.0	0.0	0.0
ESE	.001280	.000909	.000204	0.0	0.0	0.0
SE	.002927	.001446	.000092	0.0	0.0	0.0
SSE	.002363	.001679	.000377	0.0	0.0	0.0
S	.003039	.001677	.000387	0.0	0.0	0.0
SSW	.002439	.001527	.000768	0.0	0.0	0.0
SW	.001704	.003114	.001240	0.0	0.0	0.0
WSW	.003820	.003377	.000964	0.0	0.0	0.0
W	.004159	.003829	.001448	0.0	0.0	0.0
WNW	.003836	.004917	.001517	0.0	0.0	0.0
NW	.003866	.005982	.002307	0.0	0.0	0.0
NNW	.003123	.003931	.001055	0.0	0.0	0.0

TABLE G-10 (cont'd)

Summer Synthesized Site STAR

Direction	Wind Speed (km/h 0-6	7-13	14-20	21-30	31-40	>40
C STABILITY						
N	.007811	.009574	.013310	.000566	0	0.0
NNE	.003105	.005012	.006488	.000745	0	0.0
NE	.002982	.003954	.006007	.000821	0	0.0
ENE	.000627	.001207	.007239	.000140	0	0.0
E	.001184	.001611	.001003	.000024	0	0.0
ESE	.002809	.000333	.000835	.000026	0	0.0
SE	.002005	.002659	.002455	0	0	0.0
SSE	.003350	.002469	.002848	.000142	0	0.0
S	.005713	.004756	.004389	.000358	.000026	.000003
SSW	.003962	.003108	.006229	.002132	.000172	.000010
SW	.010961	.009478	.014854	.005431	.000432	.000067
WSW	.006049	.010334	.007393	.001220	.000100	0.0
W	.006023	.007300	.007710	.001674	.000118	0.0
WNW	.002612	.004540	.007277	.001475	.000042	0.0
NW	.003590	.005006	.006010	.000794	.000012	0.0
NNW	.001925	.002891	.002432	.000208	.000017	0.0
D STABILITY						
N	.008728	.021887	.007892	.002664	.000038	.000011
NNE	.003289	.007759	.004058	.001767	.000026	0.0
NE	.005315	.009918	.007628	.003786	0	0.0
ENE	.002736	.002802	.002228	.001179	0	0.0
E	.001982	.005129	.002301	.000395	0	0.0
ESE	.003899	.011171	.005013	.000860	0	0.0
SE	.003522	.012846	.004176	.000154	0	0.0
SSE	.003863	.013182	.003747	.001320	0	0.0
S	.003127	.012563	.008381	.004290	.000261	.000009
SSW	.002172	.012755	.012034	.012181	.000718	.000023
SW	.007437	.025527	.025900	.033922	.003647	.000239
WSW	.004029	.014287	.012536	.008930	.000630	.000021
W	.002992	.011437	.009821	.008840	.000397	.000007
WNW	.005820	.008669	.006219	.006201	.000388	.000007
NW	.003258	.009019	.006502	.004293	.000187	.000007
NNW	.001593	.005036	.002452	.001575	.000013	0.0

TABLE G-10 (cont'd)

Summer Synthesized Site STAR

Direction	0-6	7-13	Wind Speed (km/h 14-20	21-30	31-40	>40
E STABILITY						
N	0.0	.001271	0	0.0	0.0	0.0
NNE	0.0	.000864	0	0.0	0.0	0.0
NE	0.0	.001024	0	0.0	0.0	0.0
ENE	0.0	0	0	0.0	0.0	0.0
E	0.0	.000791	0	0.0	0.0	0.0
ESE	0.0	.002596	0	0.0	0.0	0.0
SE	0.0	.005489	0	0.0	0.0	0.0
SSE	0.0	.003187	0	0.0	0.0	0.0
S	0.0	.008753	.001682	0.0	0.0	0.0
SSW	0.0	.004699	0	0.0	0.0	0.0
SW	0.0	.011033	.001888	0.0	0.0	0.0
WSW	0.0	.006221	.003830	0.0	0.0	0.0
W	0.0	.004447	.000567	0.0	0.0	0.0
WNW	0.0	.001303	.001006	0.0	0.0	0.0
NW	0.0	.000786	0	0.0	0.0	0.0
NNW	0.0	.000466	0	0.0	0.0	0.0
F STABILITY						
N	.000425	.000503	.00	0.0	0.0	0.0
NNE	.001146	.000342	.00	0.0	0.0	0.0
NE	.001014	0	.00	0.0	0.0	0.0
ENE	.000690	.000206	.00	0.0	0.0	0.0
E	.001182	0	.00	0.0	0.0	0.0
ESE	.003146	.000682	.00	0.0	0.0	0.0
SE	.003649	.000644	.00	0.0	0.0	0.0
SSE	.001582	0	.00	0.0	0.0	0.0
S	.007245	.002816	.00	0.0	0.0	0.0
SSW	.006657	.001593	.00	0.0	0.0	0.0
SW	.015419	.003888	.00	0.0	0.0	0.0
WSW	.009889	.004432	.00	0.0	0.0	0.0
W	.000738	.000881	.00	0.0	0.0	0.0
WNW	.000865	.000259	.00	0.0	0.0	0.0
NW	.001046	.001243	.00	0.0	0.0	0.0
NNW	.000156	.000185	.00	0.0	0.0	0.0

FIGURE G-1

Array of Joint Probability of Wind Speeds at
OWMC Preferred Site and St. Catharines

Site

Wind Speed

St. Catharines	I-1	I	I = 1.....	
i-1				
Wind Speed i		P(I,i)		
i+1				

FIGURE G-2

Array of Joint Probability of Wind Directions at OWMC Preferred Site and St. Catharines

Site

Wind Direction

St. Catharines	J-1	J	J = 1.....	
j-1				
Wind Direction j		P(J,j)		
j+1				

APPENDIX H

DATA ON EXISTING AIR QUALITY FOR THE NIAGARA PENINSULA

INTRODUCTION TO APPENDIX H

This appendix provides a summary of ambient air quality monitoring data collected by the MOE for the years 1980 to 1985 inclusive at stations located in the Niagara Peninsula. Monitoring data is presented in Tables H-1 to H-12 inclusive for sulphur dioxide (SO_2), total reduced sulphur (TRS), total suspended particulate (TSP), nitrogen oxides (NO, NO_2 and NO_x), hydrocarbons (HC), carbon monoxide (CO), ozone (O_3), trace metals, dustfall and coefficient of haze (MOE, 1982, 1983, 1984, 1985, 1986, 1987 and Kiely, 1987).

TABLE H-1

Prevailing SO_2 Levels in Niagara Peninsula

(ppm)

	Annual Arithmetic Mean						Maximum 24-Hour Level	Maximum 1-Hour Level	Total No. of Criteria Exceedances		
	1985	1984	1983	1982	1981	1960			Annual	24-Hr	1-Hr
Binbrooke West	-	-	.005	.006	.006	.005	.05	.30	0	0	1
Chippawa	.005	.007	.007	.011	.029	.030	.14	.60	2	13	38
Fort Erie	.004	.005	.005	.007	.010	.007	.06	.17	0	0	0
Long Point	.002	.002	.003	.005	.006	.003	.06	.20	0	0	0
Nanticoke (086)	.003	.004	.004	.005	.005	.005	.05	.28	0	0	5
Nanticoke (907)	.002	.005	-	-	-	-	.08	.22	0	0	0
Niagara Falls (049)	-	-	.005	.003	.004	.007	.06	.11	0	0	0
Niagara Falls (055)	.006	.002	.003	-	-	-	.03	.11	0	0	0
Niagara Falls (056)	.003	.004	.003	-	-	-	.04	.11	0	0	0
Niagara Falls (149)	-	-	.007	-	-	-	.03	.08	0	0	0
Niagara Falls (156)	.005	.010	.008	-	-	-	.04	.11	0	0	0
Simcoe	.005	.004	.003	.004	.004	.007	.04	.22	0	0	0
St. Catharines (037)	.006	.005	.005	.005	.007	.004	.05	.14	0	0	0
St. Catharines (137)	.006	.006	.009	-	-	-	.06	.13	0	0	0
Thorold (042)	.005	.001	.022	.012	.040	.032	.82	2.27	2	62	544
Thorold (043)	-	-	-	-	-	.015	.11	.49	0	1	15
Thorold (046)	-	-	-	.010	.007	.010	.09	.86	0	0	16
Thorold (052)	.017	.012	.016	-	-	-	.28	.58	0	6	69
Townsend	.003	.003	-	-	-	-	.05	.35	0	0	2

Notes:
Ontario Air Quality Criteria
Annual Average .02 ppm
24-Hr. Average .10 ppm
1-Hr. Average .25 ppm
- not available due to insufficient data

TABLE H-2

Prevailing TRS Levels in Niagara Peninsula

(ppb)

	Annual Arithmetic Mean						Maximum 1-Hr Level	Total No. of Criterion Exceedances*
	1985	1984	1983	1982	1981	1980		
Chippawa	2.1	1.3	-	5.5	12.2	11.5	435	33
Nanticoke (086)	.3	.4	-	-	-	-	51	2
Nanticoke (903)	-	-	.5	.6	.4	.5	14	-
Nanticoke (904)	.2	.5	.1	.2	.3	.3	30	0
Nanticoke (905)	-	-	.1	.3	.3	.3	34	-
Nanticoke (907)	1.1	1.1	1.0	.5	.5	-	90	6
Niagara Falls (055)	1.6	.8	.8	-	-	-	36	3
Thorold (052)	2.9	4.5	5.8	-	-	-	254	242

Notes:
Ontario Air Quality Criterion
1-Hr. average 20 ppb
- not available due to insufficient data
* for 1985 only

TABLE H-3

Prevailing TSP Levels in Niagara Peninsula

($\mu g/m^3$)

	Annual Geometric Mean						Maximum 24-Hr Level	Total No. of Criteria Exceedances	
	1985	1984	1983	1982	1981	1980		Annual	24-Hr
Big Creek Reserve	32	27	32	33	-	-	125	0	1
Binbrooke West	-	-	43	39	31	43	103	0	0
Canborough East	-	-	36	39	37	41	141	0	1
Canfield South	-	-	39	41	38	46	121	0	1
Chippawa (009)	-	73	70	67	96	-	302	4	32
Chippawa (014)	44	51	46	45	65	-	221	1	12
Chippawa (051)	27	-	-	-	-	-	37	0	0
Dogs Nest	-	-	28	32	33	-	155	0	1
Fisherville	-	-	34	41	40	-	211	0	2
Fort Erie	-	-	-	-	39	-	92	0	0
Hagersville	-	-	33	42	40	-	256	0	3
Jarvis (087)	49	49	46	46	43	54	301	0	19
Jarvis (092)	37	-	-	-	-	-	135	0	2
Jarvis (960)	34	43	38	39	36	-	353	0	2
Jarvis (965)	33	45	-	-	-	-	120	0	0
Nanticoke (086)	32	36	39	37	37	53	494	0	10
Nanticoke (904)	27	32	33	37	37	41	170	0	4
Nanticoke (907)	59	58	-	-	-	-	307	0	8
Nanticoke (961)	45	40	40	37	37	42	223	0	10
Nanticoke (964)	39	42	-	-	-	-	188	0	2
Niagara Falls (049)	-	-	62	54	60	-	193	2	8
Niagara Falls (050)	-	-	-	83	86	101	361	2	32
Niagara Falls (053)	67	76	73	67	-	-	248	3	28
Niagara Falls (055)	79	103	68	63	-	-	434	3	45
Niagara Falls (056)	44	48	43	-	-	-	156	0	3
Peacock Provincial Pk	26	32	28	32	33	-	133	0	1
Port Colborne (030)	43	49	42	42	48	-	146	0	5
Port Colborne (047)	49	57	51	42	57	67	291	1	20
Port Dover (056)	-	-	29	34	40	-	138	0	1
Port Dover (090)	32	39	29	-	-	-	92	0	0
Rainham Centre	-	-	30	33	33	-	153	0	1
Sandusk	-	-	40	34	40	-	229	0	6
Selkirk	-	-	34	35	37	-	153	0	1
Simcoe	31	36	32	23	32	-	396	0	4

TABLE H-3 (contd.)

Prevailing TSP Levels in Niagara Peninsula

($\mu g/m^3$)

	Annual Geometric Mean						Maximum 24-Hr Level	Total No. of Criteria Exceedances	
	1985	1984	1983	1982	1981	1980		Annual	24-Hr
St. Catharines (008)	-	-	57	52	55	-	142	0	7
St. Catharines (037)	50	58	68	56	57	62	224	2	18
St. Catharines (059)	59	-	-	-	-	-	86	0	0
St. Catharines (060)	65	-	-	-	-	-	129	0	3
Stelco North	-	28	34	36	37	-	379	0	7
Thorold (052)	106	131	111	92	-	-	631	4	91
Townsend	36	36	-	-	-	-	178	0	2
Villa Nova	-	-	31	37	35	-	324	0	2
Welland	48	58	49	51	58	83	276	8	21

Notes:
Ontario Air Quality Criteria
Annual Average 60 $\mu g/m^3$ (Geometric mean)
24-Hr. Average 120 $\mu g/m^3$
- not available due to insufficient data

TABLE H-4

Prevailing COH (Coefficient of Haze) Levels
in Niagara Peninsula

(per 1000 feet)

	Annual Mean						Maximum 24-Hr Level	Total No. of Criteria Exceedances	
	1985	1984	1983	1982	1981	1980		Annual	24 Hr.
Binbrooke West	-	-	-	.14	.16	.15	.6	0	0
Chippawa	-	-	-	.20	.26	.23	.8	0	0
Long Point	-	-	-	.15	.13	.12	.5	0	0
Nanticoke (086)	-	-	-	.11	.15	.13	.5	0	0
Niagara Falls (049)	-	-	.24	.22	.25	.22	1.0	0	0
Niagara Falls (055)	.33	.38	-	-	-	-	1.2	0	1
Niagara Falls (056)	.20	.22	.16	-	-	-	.9	0	0
Niagara Falls (149)	-	-	.25	-	-	-	.8	0	0
Niagara Falls (156)	.26	.31	.18	-	-	-	1.2	0	1
Simcoe	.16	.18	.16	.18	.19	.17	.9	0	0
St. Catharines (037)	.26	.24	.27	.29	.32	.31	1.4	0	6
St. Catharines (137)	.30	.33	.32	-	-	-	1.6	0	5
Thorold (052)	.29	.35	.50	-	-	-	1.2	0	1

Notes:
Ontario Air Quality Criteria
Annual Average: .5 COH's/1000 feet
24-Hr Average: 1.0 COH's/1000 feet
- not available due to insufficient data

TABLE H-5

Prevailing Dustfall Levels
in the Niagara Peninsula

(grams/sq meter/30 days)

	Annual Mean					
	1985	1984	1983	1982	1981	1980
Chippawa (005)	6.7	7.9	6.4	8.1	8.8	11.8
Chippawa (006)	2.9	3.5	3.0	4.0	3.7	4.2
Greensville (073)	14.2	13.0	10.3	9.5	10.2	10.2
Greensville (074)	10.3	13.4	9.1	8.3	8.7	10.6
Greensville (075)	8.6	8.3	6.9	7.5	6.7	7.6
Greensville (076)	6.4	7.6	6.1	5.6	5.5	5.8
Greensville (096)	6.2	6.4	5.3	6.3	-	-
Greensville (097)	5.4	6.1	4.9	5.3	-	-
Nanticoke (070)	3.8	4.4	2.9	2.3	2.6	2.6
St. Catharines (040)	14.5	11.3	9.8	10.3	8.1	10.3
St. Catharines (041)	8.2	6.3	6.2	5.1	7.1	6.5
St. Catharines (054)	6.4	8.0	7.1	-	-	-
St. Catharines (059)	4.7	-	-	-	-	-
Thorold (042)	7.7	7.8	9.1	9.8	12.2	11.8
Thorold (043)	3.9	4.2	3.7	4.1	6.0	4.4
Welland (025)	4.8	4.9	4.5	4.6	6.1	7.3
Welland (026)	4.9	6.0	6.0	4.8	6.9	8.6
Welland (035)	7.4	10.2	8.8	5.6	14.9	19.4

Notes:

Ontario Air Quality Criteria
1 month - 7.0 $g/m^2/30$ days
1 year - 3.5 $g/m^2/30$ days
- not available due to insufficient data

TABLE H-6

Prevailing Nitric Oxide Levels in the Niagara Peninsula

(ppb)

	Annual Average						Maximum 24-Hr Level	Maximum 1-Hr Level
	1985	1984	1983	1982	1981	1980		
Binbrooke West	-	-	5	4	7	5	60	150
Long Point	0	1	1	1	2	7	40	130
Nanticoke (086)	1	1	1	1	1	2	30	170
Sandusk	-	-	4	4	8	9	30	140
Simcoe	4	5	2	2	2	1	30	120
St.Catharines (037)	9	16	9	8	14	9	240	720

- not available due to insufficient data

TABLE H-7

Prevailing Nitrogen Dioxide Levels in the Niagara Peninsula

(ppb)

	Annual Average						Maximum 24-Hr Level	Maximum 1-Hr Level	Total No. of Criteria Exceedances	
	1985	1984	1983	1982	1981	1980			24-Hr	1-Hr
Binbrooke West	-	-	10	10	-	-	40	70	0	0
Long Point	4	4	6	7	-	-	30	140	0	0
Nanticoke (086)	3	4	8	7	10	8	50	100	0	0
Sandusk	-	-	9	10	-	-	30	70	0	0
Simcoe	6	9	9	10	14	12	50	90	0	0
St.Catharines (037)	17	18	20	19	22	20	80	290	0	4

Notes:
Ontario Air Quality Criteria
24-Hr. Average 100 ppb
1-Hr. Average 200 ppb
- not available due to insufficient data

TABLE H-8

Prevailing Nitrogen Oxides Levels in the Niagara Peninsula

(ppb)

	Annual Average						Maximum 24-Hr Level	Maximum 1-Hr Level
	1985	1984	1983	1982	1981	1980		
Binbrooke West	-	-	15	14	18	14	110	210
Long Point	3	4	7	8	10	14	50	110
Nanticoke (086)	4	6	8	8	11	9	70	260
Sandusk	-	-	13	16	16	17	50	290
Simcoe	10	13	11	12	17	13	50	140
St. Catharines	76	34	29	27	36	30	320	830

Note:
- not available due to insufficient data

TABLE H-9

Prevailing Hydrocarbon Levels
in the Niagara Peninsula

(ppm)

	1985	1984	1983	1982	1981	1980	Maximum Level 24-Hr	Maximum Level 1-Hr
Reactive Hydrocarbons								
Nanticoke (086)	.07	.15	-	-	-	-	.5	1.5
Nanticoke (903)	-	-	.27	.64	.67	.36	2.3	17.0
Nanticoke (904)	.06	.18	.40	.51	.52	.55	1.7	7.7
Nanticoke (905)	-	-	.18	.60	.78	.66	1.2	1.9
Simcoe	.22	.17	.20	.20	-	-	.4	.8
St. Catharines (037)	.20	.14	.20	.49	.41	.20	1.1	5.8
Methane								
Nanticoke (086).	1.62	1.58	-	-	-	-	2.0	3.6
Nanticoke (903)	-	-	1.64	1.46	1.48	1.44	2.2	4.7
Nanticoke (904)	1.62	1.47	1.44	1.55	1.40	1.36	2.9	5.9
Nanticoke (905)	-	-	1.59	1.54	1.53	1.48	2.2	5.7

Note:

- not available due to insufficient data

TABLE H-10

Prevailing Carbon Monoxide Levels
in the Niagara Peninsula

(ppm)

	1985	1984	1983	1982	1981	1980	Maximum 1-Hr. Level	Maximum 8-Hr. Level	No. of Criteria Exceedances 1-Hr. Level	No. of Criteria Exceedances 8-Hr. Level
Binbrooke West	-	-	.1	.1	.1	.1	9	2	0	0
Long Point	-	-	.2	.1	.2	.1	4	3	0	0
St. Catharines (037)	.2	.4	.4	.4	1.0	.6	15	10	0	0

Notes:
Ontario Air Quality Criteria
1 Hr Average 30 ppm
8 Hr Average 13 ppm
- not available due to insufficient data

TABLE H-11

Prevailing Ozone
in the Niagara Peninsula

(ppb)

	1985	1984	1983	1982	1981	1980	Maximum 1-Hr Level	No. of Criterion Exceeedances
Binbrooke West	-	-	24	25	24	24	116	110
Long Point	34	31	30	34	31	33	136	1019
Simcoe	31	29	30	32	29	26	123	680
St. Catharines (037)	18	20	23	21	20	21	138	280

Notes:
Ontario Air Quality Criterion
1-Hr Average 80 ppb
- not available due to insufficient data

TABLE H-12

Prevailing Trace Metal Levels in Niagara Peninsula

($\mu g/m^3$)

	Maximum 24-hr Level									
	Cadmium	Cobalt	Copper	Chromium	Iron	Lead	Manganese	Nickel	Vanadium	Zinc
Nanticoke (904)	-	-	-	-	-	.3	-	-	-	-
Niagara Falls (049)	-	-	-	-	2.3	1.0	-	-	-	-
Niagara Falls (056)	.004	-	.37	.013	-	.2	.039	.012	.050	.2
Port Colborne (030)	-	-	-	-	-	-	-	1.48	-	-
Port Colborne (047)	-	-	-	-	-	-	-	3.43	-	-
Simcoe	.043	.01	3.43	.024	11.8	.4	1.04	.111	.073	.2
St. Catharines (008)	.009	-	1.09	.020	4.0	.7	.177	.041	.037	.3
St. Catharines (037)	.005	.01	.28	.012	3.2	1.2	.106	.696	.022	-
St. Catharines (059)	.001	.01	.75	.022	3.4	.7	.217	.011	.006	-
St. Catharines (060)	.001	.01	.24	.016	2.1	.6	.158	.010	.004	-

Notes:

Ontario Air Quality Criteria
Cadmium - 24-hr Average 2 $\mu g/m^3$
Lead - 24-hr Average 5 $\mu g/m^3$
Nickel - 24-hr Average 2 $\mu g/m^3$
Vanadium - 24-hr Average 2 $\mu g/m^3$
- not available due to insufficient data

TABLE H-12 (Contd)

Prevailing Trace Metal Levels in Niagara Peninsula

($\mu g/m^3$)

	Range of Annual Geometric Means									
	Cadmium	Cobalt	Copper	Chromium	Iron	Lead	Manganese	Nickel	Vanadium	Zinc
Nanticoke (904)	-	-	-	-	-	.1	-	-	-	-
Niagara Falls (049)	-	-	-	-	.5	.1-.2	-	-	-	-
Niagara Falls (056)	.001	-	.20	.002	-	.1	.014	.001	.001	.1
Port Colborne (030)	-	-	-	-	-	-	-	.026-.102	-	-
Port Colborne (047)	-	-	-	-	-	-	-	.029-.072	-	-
Simcoe	.000-001	-	.06-.44	.001	.2-.4	.1	.006.018	.001-.003	.001	0-.1
St. Catharines (008)	.001	-	.13-.24	.001-.002	.6-.7	.2	.024-.040	.001	.001-.003	0-.1
St. Catharines (037)	-	-	.12	-	.8	.2-.3	.042	.003-.045	-	-
St. Catharines (059)	-	-	.61	-	1.5	.2	.077	.006	-	-
St. Catharines (060)	-	-	.16	-	1.0	.2	.066	.004	-	-

Notes:

Ontario Air Quality Criteria
Cadmium - 24-hr Average 2 $\mu g/m^3$
Lead - 24-hr Average 5 $\mu g/m^3$
Nickel - 24-hr Average 2 $\mu g/m^3$
Vanadium - 24-hr Average 2 $\mu g/m^3$
- not available due to insufficient data

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APPENDIX I

GENERAL AMBIENT AIR CONCENTRATIONS OF TRACE ORGANICS AND INORGANIC CONSTITUENTS

INTRODUCTION TO APPENDIX I

A literature search was conducted to collect all available data on concentrations of air pollutants in various airsheds around the world. From the references obtained, a summary of ambient air concentrations of air pollutants was compiled (see Table I-1). These air pollutants included both trace organics as well as inorganic constituents. Airsheds were classified as either urban, rural or remote. Ambient concentrations were expressed as nanograms per cubic meter (ng/m^3). The ranges of ambient concentrations noted in the table incorporate all the values referenced from the various airsheds. All values were treated as though they had been obtained under similar conditions. In reality, however, sampling method, duration and conditions varied from one study to the next. In addition, some of the reported values were peak levels, whereas others represented average concentrations.

TABLE I-1

Summary of Ambient Air Concentrations of Trace Organics and Inorganic Constituents in Various Airsheds

	Ambient Concentration Ranges (ng/m^3)			Locations
	Urban	Rural	Remote	
ACID GASES				
Hydrogen Chloride	<500-12100[1]			1. Japan
Hydrogen Fluoride	<1000[2]	N.D.[2]		2. U.S.
Hydrogen Sulphide				3. U.S.
				4. Australia
ORGANICS			8-65[64]	10. Western Europe
				12. Worldwide
Acetic Acid				19. Colorado
Acetone			710-6900[37]	20. Toronto, Ontario
Acetaldehyde	1800-7198[48]	288-1440[52]		36 Sweden
Acetonitrile		3700-10400[10]		37. Alaska
Acetylene	5300-106000[3,4,63,70]	500-5800[3,63,70]	0-400[3]	39. Los Angeles
Acrolein	92-26500[36]			43. S. California
Acrylamide				48. U.S.
Acrylonitrile	390-455[69]			52. New York
Aldrin	8[12]	0-1[12]		63. England, Australia and California
Alpha-Napthol				
Benzene	319-608900[12,20,36,43,65,66,68,70]	700-7000[19,70]		64. Gulf of Guinea
Benzo(a)pyrene	0.467-0.967[71]	0-144[71]		65. U.S.
Benzothiazole				66. New Jersey
Benzoyl Chloride				68. New Jersey
Biphenyl				69. West Germany
Bromocil				70. U.S.
Butanal	177-23500[36,39]			71. Japan
i-butane	16634-92912[63,70]	1188-33506[63,70]		
n-butane	26852-152082[63,70]	1188-53229[63,70]		
3-Buten-z-one	57-7100[36]			
1-butene	2294-20191[63,70]	1147-15602[63]		
i-butene	2294-13767[70]	1147[70]		
c-2-butene	6425[63]	1147[63]		

TABLE I-1 (Cont'd)

Summary of Ambient Air Concentrations of Trace Organics and Inorganic Constituents in Various Airsheds

	Ambient Concentration Ranges (ng/m^3)			Locations
	Urban	Rural	Remote	
t-2-butene	2294-11472[63,70]	2983-3671[63]		8. New Jersey
n-Butyl Acetate				9. New Jersey
Butyl Acrylate	ND-17000[9]			12. Worldwide
Butyl Stearate				13. U.S.
Carbon Tetrachloride	63-4500[33,65,66,68]			21. New York
Cellosolve Acetate				33. Germany
Chlordane	.1-.5[12]	.01-.05[12]		63. England, Australia and California
Chlorinated Naphthalenes	10-25[12]			
Chloroform	200-37000[9,33,65,66,68]		80[13]	
Chlorobenzene	414-1013[66,68]			65. U.S.
Chlorotoluenes	104-2175[66,68]			66. New Jersey
Cresols				68. New Jersey
Cyclohexane				70. U.S.
2,4-D		4[12]		
DDT	.1-1[12]	.01-.05[12]		
Decaborane				
Decene-1				
Diazinon				
Diborane				
1,2-Dibromoethane	77[66]			
Dibutyl Phthalate	ND-11[21]	0.5-5.0[12]		
Dibutyltin Dilaurate				
Dicapryl Phthalate				
Dichlorobenzenes	66-1000[65,66,68]			
1,2-Dichloroethane	ND-54600[8,9,66,68]			
Dieldrin	.5-10[12]	.01-.1[12]		
Diethyl Hexyl Phthalate	ND-28.6[21]	0.5-5.0[12]		
Difluoro Dichloromethane			1000[13]	
2,2-Dimethyl Butane	154772[63]	6346-15512[63]		
Dimethyl Disulphide				
Dimethyl Ether				

TABLE I-1 (Cont'd)

Summary of Ambient Air Concentrations of Trace Organics and Inorganic Constituents in Various Airsheds

	Ambient Concentration Ranges (ng/m^3)			Locations
	Urban	Rural	Remote	
Dimethyl Nitrosamine	20-100[11]			4. Australia
2,2-Dimethyl Propane	16566[63]	3839-4429[63]		5. California
Dimethyl Sulphide				6. U.S.
Dioctyl Phthalate				7. Background
Dioxane	71-499[66,68]			11. U.S.
Dioxins				12. Worldwide
Dioxins & Furan Mixtures				15. Worldwide
Dodecyl Benzene Sulphonic Acid				17. Ontario
Droperidol				36. Sweden
Endrin		2.3-58.5[12]		38. Los Angeles, Ca
Ethane	9849-54414[63,70]	2462-36317[63,70]		40. Tokyo,Japan
Ethanol	1147-46440[36]			48. U.S
2-Ethyl Hexanol				52. New York
Ethyl Alcohol				53. Simcoe,Ontario
Ethyl Acetate	36-75500[36]			54. St. Louis, Mi
Ethyl Acrylate				63. England, Australia and California
Ethyl Benzene	999-358800[15,36,54,65 66,68,70]			65. U.S.
Ethyl Ether				66. New Jersey
Ethylene	14300-120000[4,5,63]	172-13791[53,63]		68. New Jersey
Ethylene Dichloride				70. U.S.
Ethylene Glycol Dinitrate				
Fentanyl Citrate				
Fluoranthene	0.3-93[17]			
Formaldehyde	638-87050[6,36,38 40,48,52]	736-3190[52]	120-3100[7,48]	
Formic Acid				
Furfural				
Furfuryl Alcohol				
Haloperidol				

TABLE I-1 (Cont'd)

Summary of Ambient Air Concentrations of Trace Organics and Inorganic Constituents in Various Airsheds

	Ambient Concentration Ranges (ng/m^3)			Locations
	Urban	Rural	Remote	
Heptachlor	2-20[12]	1-5[12]		2. U.S.
Hexachlorobenzene		0.1-0.3[12]		3. U.S.
Hexachloroethane			70[14]	4. Australia
Hexamethyl Disilazane				9. New Jersey
Hexane	7400-260000[3,4,70,63]	106-598[53,63,70]		12. North America
				13. U.S.
c-3-hexane	6199[63]	1722-4821[63]		14. Worldwide
t-3-hexane	5854[63]	1722-3788[63]		15. Worldwide
Isopropyl Alcohol				22. Ontario
				36. Sweden
Isopropyl Benzene	1900-96000[15]			53. Simcoe,Ontario
Lindane + αBHC	2-10[2]	1-4[12]		63. England, Australia and California
4,4-Methylene-Bis-2 Chloroaniline				
Malathion		2[12]		70. U.S.
Maleic Anhydride				
Mercaptans (as Methyl Mercaptan)				
Mercaptobenzothiazyl Disulphide				
Mercury (Alkyl)	<3[22]	<3[22]		
Methacrylic Acid				
Methane diphenyl di-isocyanate				
Methanol	590-94700[36]			
Methacrolein	30-6500[36]			
Methoxychlor				
Methyl Acrylate	ND-4500000[9]			
Methyl Alcohol				
Methyl Bromide			20[13]	

TABLE I-1 (Cont'd)

Summary of Ambient Air Concentrations of Trace Organics and Inorganic Constituents in Various Airsheds

	Ambient Concentration Ranges (ng/m^3)			Locations
	Urban	Rural	Remote	
3-Methylbutanal	35-1580[36]			9. New Jersey
2-methyl-1-butene	1145[63]	1431[63]		12. North America
3-methyl-1-butene	9533[63]	1431-2863[63]		13. U.S.
Methyl Chloride			1470[13]	18. Sweden
Methyl Chloroform				36. Sweden
Methyl Isobutyl Ketone				63. England, Australia and California
Methyl Ethyl Ketone	736-94176[36]			66. New Jersey
Methyl Ethyl Ketone Peroxides				68. New Jersey
Methyl Methacrylate				70. U.S.
Methyl Parathion		5.4-129[12]		
2-Methyl Pentane	24679-70511[63,70]	1763-705[63]		
3-Methyl Pentane	17628-115638[63,70]	1763-1339[63]		
2-Methyl Propene	137[63]	4360-4590[63]		
Methyl Salicylate				
Methylene Chloride	1632-5347[66,68]		150[13]	
Methylene Dianiline				
Methylene Di-p-Phenylene Isocyanate				
Miconazole Nitrate				
Monomethyl Amine				
Naphthalene		70-1300[18]		
Nitrobenzenes	ND-2115[9,66,68]			
Nitrilotriacetic Acid				
1-Octene				
Oxalic Acid				
Parathion		465[12]		
n-Propyl Alcohol				
Pentaborane				

TABLE I-1 (Cont'd)

Summary of Ambient Air Concentrations of Trace Organics and Inorganic Constituents in Various Airsheds

	Ambient Concentration Ranges (ng/m^3)			Locations
	Urban	Rural	Remote	
Pentachloroanisole		0.0021-0.009[46]		12. North America
Pentachlorophenol	0.25-7.28[16]			16. Europe
Pentanal	141-7000[36]			35. Ontario
i-pentane	66442-19784[63,70]	1476-1476[63,70]		36. Sweden
n-pentane	24510-11221[63,70]	1476-1447[63,70]		41. Norway
1-pentene	2495[4][63]	2868-4302[63]		46. New Zealand and American Samoa & Gulf of Mexico - Mustang Island
c-2-pentene	888[8][63]	573-1434[63]		
t-2-pentene	4587[3][63]	1147-1434[63]		
Perchloroethylene				
Peroxyacetylnitrate		4454-9898[47]		47. Simcoe,Ontario
Phenol				58. Ivory Coast
Phosgene				61. Oslo,Norway
Phosphorus Oxychloride				63. England, Australia and California
Phosphorus Pentachloride				
Phthalic Anhydride				
Pimozide				65. U.S.
Polybutene 1-Sulphane				66. New Jersey
Polychlorinated Aromatic Hydrocarbons	.5-92.4[58]	9-377[41,61]	.1-70[58]	68. New Jersey
PCBs	.5-74[12,35]	.1-23[12,35]	.02-.5[12]	70. U.S.
Polychloroprene				
Propane	16233-91988[63,70]	2706-39501[63,70]		
2-Propanal	123-107900[36]			
Propionic Acid				
Propionic Anhydride				
Propylene	6888-29272[63,70]	861-13431[63,70]		
Propylene Dichloride				
Propylene Oxide				
Styrene	383-1150[65,66,68]			

TABLE I-1 (Cont'd)

Summary of Ambient Air Concentrations of Trace Organics and Inorganic Constituents in Various Airsheds

	Ambient Concentration Ranges (ng/m^3)			Locations
	Urban	Rural	Remote	
Tetrahydroquinone dimethyl ether			0.0062-0.0134[46]	8. New Jersey 9. New Jersey
Tetrahydrofuran				12. Worldwide
Tetrachloromethane	360-29000[8]			13. U.S.
Tetra methyl thurium Disulphide				15. Worldwide
Tetrachloroethane	TR-13000[8,9,66,68]	540[13]		18. Sweden
Tetrachloroethylene	2170-6800[65,66,68]			20. Toronto,Ontario
Toluene	600-1334800[12,20,36,54 66,68,70]	1883-12000[18,70]		33. Germany 36. Sweden
Toluene Di-isocyanate				46. New Zealand and American Samoa & Gulf of Mexico - Mustang Island
Toxaphene	.02-10[12]	.02-2[12]		
2,4,6-Tribromoanisole			.018-.055[46]	
Trichlorobenzene	ND-867[9]			54. St. Louis, Missouri
Trichloroethane	273-50000[33,65,66,68]			65. U.S.
Trichloroethylene	ND-200000[8,9,33,36 65,66,68]	100-1000[12]	80[13]	66. New Jersey 68. New Jersey
Trifluorotrichloroethane			150[13]	70. U.S.
Trimethyl Amine				
Trimethyl Benzene	1963-103239[15,54,70]	2458-4916[70]		
Tripropyltin Methacrylate				
Vinyl Chloride	ND-120000[8,9,66]			
Vinylidene Chloride	674-2737[66,68]			
Xylenes	0-923000[15,36,54,65 66,68,70]	2172-6515[70]		

TABLE I-1 (Cont'd)

Summary of Ambient Air Concentrations of Trace Organics and Inorganic Constituents in Various Airsheds

	Ambient Concentration Ranges (ng/m^3)			Locations
	Urban	Rural	Remote	
OTHERS				1. Japan 23. Worldwide 25. Ontario 34. Canada and Europe 42. Kenya 44. Phoenix, Arizona 45. Tallahasse, Europe, North Atlantic and Bahamas 49. Sweden 51. Leeds, UK and Haverah PK, UK 53. Simcoe, Ontario 55. New York 56. Mexico City 59. Belgium 60. Copenhagen, Denmark 67. Beijing, China 71. Japan 72. Greenland
Aluminum	606-11850[34,67,71]	30-12216[25,34 67,71]	1.91-161[34,55,72]	
Ammonia				
Ammonia Chloride				
Ammonium	3000-4700[44,51]	1300-3400[51,53]		
Arsenic	2-2320[23,34,67]	0.2-329[23,34]	.007-1.9[23,34]	
Boron				
Boron Tribromide				
Boron Trichloride				
Boron Trifluoride				
Bromide	290[44]			
Bromine	45.5-375[34,67]	<.2-460[34,49 56,67]	1.02-4.95[34,72]	
Calcium Cyanide				
Calcium Hydroxide				
Calcium Oxide				
Carbon Black	920-25200[44,45]		39-534[45]	
Carbon Disulphide				
Carbon Monoxide	5496933[44]	57260-171779[42]		
Chloride	<500-15500[1,44,51]	1500-2000[51,60]		
Chlorine	971-3790[34,67]	18-3400[34,49 59,67]	12-1174[34,55,72]	
Chlorine Dioxide				
Cyanide (HCN)				

TABLE I-1 (Cont'd)

Summary of Ambient Air Concentrations of Trace Organics and Inorganic Constituents in Various Airsheds

	Ambient Concentration Ranges (ng/m^3)			Locations
	Urban	Rural	Remote	
Ferric Acid				25. Ontario
Fluoride	10-13200[29,30,32]		<50[31]	28. Ontario
Hydrogen Peroxide				29. U.S.
Lithium Hydrides				30. U.S.
Magnesium Compounds	710[44]	5-3790[25]		31. Canada
Magnesium Oxide				32. North America
Nickel Carbonyl				34. Europe and Canada
Nitrate	1500-11500[28,44,51]	50-10800[25,51,53,60]		41. Norway
Nitrogen dioxide	26339-714928[44,71]	16933-24458[60,71]		44. Phoenix, Arizona
Nitrogen monoxide	12270-245399[44,71]	8589[71]		47. Simcoe, Ontario
Nitrogen oxides	714928[44]	49734[60]		51. Leeds, UK and Haverah PK UK
Nitroglycerin				53. Simcoe, Ontario
Ozone	11779[44]	33374-72049[47]		55. New York-Alesund
Particulates		20,000-62,000[41]		59. Belgium
Phosphine				60. Copenhagen Denmark
Phosphorus	902-1502[67]	754-1214[67]		67. Beijing, China
Potassium Cyanide			11-161[55]	71. Japan
Selenium	1.64-6[34,71]	0.95-20[34,59,71]	.048[34]	72. Greenland
Silica	3552-37520[67,71]	574-31630[67,71]	19.07-260.39[72]	
Silane				
Sodium Chlorite				
Sodium Cyanide				
Sodium Hydroxide				
Stannous-Chloride (as tin)				
Sulphate	2400-18000[28,44,51]	1100-20900[25,51,53,60]		
Sulphur	3740-7020[67]	2100-3410[67]	93.77-205.77[72]	
Sulphur Dioxide	18352-31460[71]	5795-24344[53,60,71]		

TABLE I-1 (Cont'd)

Summary of Ambient Air Concentrations of Trace Organics and Inorganic Constituents in Various Airsheds

	Ambient Concentration Ranges (ng/m^3)			Locations
	Urban	Rural	Remote	
METALS				22. Ontario
Antimony	.5-470[23,34]	1-146[23,34]	.0008-1.19[23,34]	23. Worldwide
Arsine				24. California
Barium		7.3[59]		25. Ontario
Beryllium				26. U.S.
Cadmium	.17-7000[23,34]	.4-1000[23,25,34,59]	.003-1.09[23,55]	27. Canada
Calcium	2370-24845[34,44,67]	<8-18070[25,34,49,67]	1-140[34,55,72]	34. Canada and Europe
Chromium	<0.3-227[23,34,67]	1-201.1[23,25,34,49,59,67]	.0053-11.2[23,34,55,72]	44. Phoenix,Arizona
Cobalt	0.2-183[23,34]	0.1-6.2[23,34,59]	.00049-1.9[23,34]	49. Sweden
Copper	<3-5140[23,34,67,71]	29-650[23,25,34,49,56,67,71]	0.07-10[23,34,55,72]	50. Spanish Coast
Iron	130-20600[23,34,44,67,71]	<2-14500[23,25,34,49,67,71]	.63-4160[23,34,55,72]	55. New York
Lead	49.9-54000[27,44,50,57,67,71]	ND-800[25,26,34,49,56,67,71]	.1-4.98[55,72]	56. Mexico City
Lithium				57. Saudi Arabia
Manganese	9-850[23,34,67]	ND-232.5[23,25,34,49,67]	0.01-79[23,34,55,72]	59. Belgium
Mercury	2-80[22]	2-7[22,62]	<.5-20.2[24,62]	60. Copenhagen Denmark
Nickel	0.3-1400[23,67,71]	2.91-140[23,25,49,60,67,71]	<.01-1.2[23,55,72]	62. Italy
Palladium				67. Beijing, China
Potassium	670-4030[44,67]	<26-7857[49,59,67]	1.5-49[55,72]	71. Japan
Platinum				72. Greenland

TABLE I-1 (Cont'd)

Summary of Ambient Air Concentrations of Trace Organics and Inorganic Constituents in Various Airsheds

	Ambient Concentration Ranges (ng/m^3)			Locations
	Urban	Rural	Remote	
Silver				23. Worldwide
Strontium			0.06-1.00[72]	25. Ontario
Tellurium				34. Canada and Europe
Tin	.00007-.900[45]	0.058[45]	.00027-.0737[45]	45. Tallahassee, Cape Grim, Europe, Rhode Island North Atlantic Pacific and New Zealand
Titanium	46.7-1350[67,71]	<4-1275[49,56 67,71]	0.1-3.56[55,72]	49. Sweden
Vanadium	0.16-1460[23,34 67,71]	1-97[23,25,34,49 60,67,71]	.0015-14[23,34,55]	55. New York-Alesund
Zinc	ND-8330[23,34,67]	<0.6-4620[23,34,49 67]	.03-460[23,34 55,72]	56. Mexico City
				60. Copenhagen, Denmark
				67. Beijing, China
				71. Japan
				72. Greenland

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APPENDIX J

EMISSION ESTIMATES - CONSTRUCTION

J-1 INTRODUCTION

This Appendix summarizes the parameters and assumptions used in the estimation of fugitive emissions during construction of the OWMC facility. These are subject to change as new engineering information becomes available.

J-2 ASSUMPTIONS USED IN THE MODELLING OF FUGITIVE EMISSIONS FROM CONSTRUCTION SOURCES

The following assumptions and parameters were used in the calculation of fugitive emissions from construction sources:

1. The area of the berm disturbed by under construction was assumed to be 100 m. The area of the central operating area was assumed to be 450 m x 1000 m, including excavation of the surface water and fire water ponds at the south end of the central operating area. The area of the storm water pond under construction was taken as 100 m x 300 m. These areas are larger than the corresponding facility dimensions to allow for construction vehicle movements, and essentially represent disturbed areas during construction.

2. Vehicle movements and materials handled estimated for the month of June or July were used for the worst-case (short-term) calculations, as these appeared to be the months with the highest construction activity levels. Annual estimates were based on the projected year-round construction activities, while the summer estimates were based on activities in the months of June, July and August (Monenco, 1986).

3. Watering and/or other mitigation on the unpaved roads was assumed to be equivalent to precipitation 90% of the time and wind erosion dust emissions were assumed to be controlled with an efficiency of 90% (USEPA, 1985).

4. The soil moisture for the clay being excavated at the site was assumed to be 20% (Spangler and Handy, 1973), while 1% moisture was assumed for gravel (USEPA, 1985).

5. A silt content of 20% for exposed clay, and gravel was assumed, (USEPA, 1985, Spangler and Handy, 1973).

6. One m^3 of clay assumed to weigh approximately 2 000 kg; one m^3 of gravel assumed to weigh approximately 2 500 kg (USEPA, 1985; assumption based on comparison with other substances).

7. All construction activity calculations were based on a 150 000 t/a facility (Monenco, 1986).

8. Construction activities assumed to take place 8 hours per day, 250 days per year (Monenco, 1986).

9. A drop height of 1.5 m was used for unloading materials.

10. The following construction vehicle characteristics were used in deriving emission factors (from Monenco, 1986, Caterpillar, 1986, USEPA, 1985):

Vehicle	Quantity On Site Working	Travel Speed kph	Weight (Mg)	No. of Wheels
Central Operating Area				
70 t crane	2	4	70	4
150 t crane	2	4	150	4
22 t cherrypicker	6	6	22	4
dump trucks	10	12	30	10
pickup trucks	12	15	1.8	4
cleanup trucks	5	5	12	4
backhoe	2	3	63	4
front end loader	1	12	27	4
D6 bulldozer	1	8	15.5	4
Berm				
625 scrapers	2	8	32	4
D8 scrapers	1	8	37	4
2 m^3 backhoe	8	3	63	4
4 m^3 front end loader	5	12	27	4
D6 bulldozer	6	8	15.5	4
grader	1	6	24.3	6
Stormwater Excavation Pond				
backhoe	1	3	63	4
dump truck	1	12	31	10
pick-up truck	1	15	1.8	4
front end loader	1	12	27	4
D6 bulldozer	1	8	15.5	4

As some of the vehicles listed above have tracks instead of wheels, the minimum suggested number for the emission factor equation (4 wheels) was used in place of 2 tracks.

11. Bulldozers, front end loaders, scrapers, pick up trucks, clean up trucks, and graders were assumed to be moving 80% of the hours in the working day; all others assumed to be moving 40% of the time, dumptrucks 33% (Dillon, 1987a and OWMC 1987).

12. Materials delivery, and excavated soil delivery amounts taken from the Monenco Construction Plan (Monenco, 1986). Each load would travel into the site or location, unload, and exit the site (total 1 km) travelled.

13. The exposed areas subject to wind erosion assumed to be 20 ha at the central operating area, 3 ha of the berm, and 5.25 ha for the storm water pond area. The rest of the berm was assumed to be grassed or not disturbed. A 90% mitigation effectiveness was applied (to the exposed areas defined above) (USEPA, 1985).

14. Soil removal/handling from the central operating area was assumed to be in 10 m^3 capacity dump trucks (Monenco, April 1986); soil removal/handling from the excavation of the storm water pond was assumed to be in 14 m^3 capacity trucks (Dillon, 1987b).

15. At any one time, 2 scrapers, 2 bulldozers and 1 grader were assumed to be operating on the berm, 1 bulldozer on the central operating area.

16. 90% control of potential emissions from scraper, bulldozing operations was assumed.

17. Emission factor equations used in the analysis are given below (USEPA, 1985):

Unpaved Roads

$$E = k\ (1.7)\left(\frac{s}{12}\right)\left(\frac{S}{48}\right)\left(\frac{W}{2.7}\right)^{0.7}\left(\frac{w}{4}\right)^{0.5}\left(\frac{365-p}{365}\right)$$

E = emission factor (kg/Vehicle km travelled)
k = particle size multiplier (for ≤30 μm k = .8)
s = silt content of road surface material (%)
S = mean vehicle speed (km/hr)
W = mean vehicle weight (Mg)
w = mean number of wheels
p = number of days with at least 0.254 mm of precipitation per year

Batch Drop Handling

$$E = k\ (.0009)\ \frac{\left(\frac{s}{5}\right)\left(\frac{U}{2.2}\right)\left(\frac{H}{1.5}\right)}{\left(\frac{M}{2}\right)^{2}\left(\frac{y}{4.6}\right)^{0.33}}$$

E = emission factor (kg/Mg of material handled)
k = particle size multiplier (for ≤30 μm, k = .73)
s = material silt content (%)
U = mean wind speed (m/s)
H = drop height (m)
M = material moisture content (%)
y = dumping device capacity (m^3)

Bulldozing

$$E = \frac{2.6\ (s)^{1.2}}{(M)^{1.3}}$$

E = emission factor (kg/hr)
s = % silt
M = % moisture

Scraping

$$E = 9.6 \times 10^{-6}\ (s)^{1.3}\ (W)^{2.4}$$

E = emission factor (kg/vehicle km travelled)
s = silt content (%)
W = vehicle weight (Mg)

Grading

$$E = .0034\ (S)^{2.5}$$

E = emission factor (kg/vehicle km travelled)
S = speed travelled (kph)

Paved Roads

for TSP,

$$E = 10.$$

E = emission factor (g/vehicle km travelled)

Soil Erosion/Wind Erosion

$$E = 1.9 \left(\frac{s}{1.5}\right)\left(\frac{365 - p}{235}\right)\left(\frac{f}{15}\right)$$

E = emission factor (kg/day/hectare)
s = silt content (%)
p = no. of days in a year with greater than .254 mm precipitation
f = percent of time that wind speed exceeds 5.4 m/s

18. Derived emission rates of fugitive dust based on the above are given in Table J-1.

19. Emission rates of TSP, CO, HC and NO_x, for vehicle exhausts and paved road surfaces are given in Table J-2.

20. For vehicle exhaust and paved road dust emission calculations, off-site vehicle speeds of 80 km/hr along Highway 20 were assumed.

21. The "average" hourly case assumed that the total daily number of vehicles in 1990 (with or without the facility) were divided by 24. Neutral stability conditions and light winds (3 m/s) were assumed. For the OWMC "worst-case" scenario, it was assumed that half the daily car traffic attributable to the facility occurred during one

peak hour and one-eighth of the daily truck traffic occurred during this hour. Extremely stable conditions and extremely light wind conditions (1 m/s) were assumed for this scenario. To obtain the worst-case hourly values for existing conditions (without the facility), daily traffic flows were divided by 12.

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TABLE J-1

Short-Term, Annual and Summer Construction Dust Emission Factors (g/s)
(90% control)

	Short-Term			Summer			Annual		
	Central Operating Area	Berm	Storm Water Pond	Central Operating Area	Berm	Storm Water Ponds	Central Operating Area	Berm	Storm Water Ponds
Roads									
Const. Veh.	2.13	2.89	1.56	1.01	1.25	0.28	1.01	1.25	0.14
Mat'l Del.	0.85	-	-	0.14	-	-	0.07	-	-
Soil Removal	1.22	-	0.49	0.24	-	0.17	0.13	-	0.08
Soil Delivery	-	1.32	-	-	0.26	-	-	0.14	-
Handling									
Excav. Clay	.003	.002	.0017	.0008	.0005	.0008	.0006	.0004	.0005
Gran. Mat'l	0.53	-	-	0.10	-	-	0.06	-	-
Dozing	-	0.11	0.05	-	0.02	0.01	-	0.02	0.01
Scraping	-	0.67	-	-	0.12	-	-	0.12	-
Grading	-	0.05	-	-	0.01	-	-	0.01	-
Wind Erosion	-	-	-	1.78	.27	.47	1.17	.18	.31
TOTAL	4.73	5.04	2.11	3.27	1.93	0.92	2.45	1.72	0.54

- not applicable

TABLE J-2

Mobile Source Emission Rates - Construction
(Off-Site Traffic)

Re-entrained road dust emissions from paved roads were estimated using:

10 g/vkt — vkt = vehicle km travelled (from AP42 11.2.5-5 - USEPA, 1985)

At 80 km/hr, TSP emission rate from each vehicle is:

0.22 g/s

Vehicle Exhaust Emission Rates (g/km) used were:

	CO	NO_x	HC
Trucks	2.6	7.4	1.2
Cars	6.6	0.74	0.52

from AP-42 (USEPA, 1985)

APPENDIX K

DISPERSION MODELLING

K-1 INTRODUCTION

Mathematical dispersion modelling was used to represent the expected dispersion pattern of emissions from the OWMC stacks and from sources of fugitive emissions during construction and operation of the facility. The U.S. Environmental Protection Agency's (EPA's) Industrial Source Complex - Long-Term Model (ISCLT) (Bowers et al, 1979) was used to model long-term concentrations at receptors around the OWMC facility. Short-term estimates of concentration at points downwind of a source were calculated in two ways, i.e., a) using the basic Gaussian plume model as suggested by Pasquill and modified by Gifford (e.g., see Turner, 1970), and b) with the Ontario Regulation 308. Some of these models were used in previous studies for OWMC to provide a detailed comparative evaluation of the OWMC's siting options (ORF, 1985), and to define existing air quality in the candidate areas (ORF, 1984).

K-2 LONG-TERM DISPERSION MODELLING

The U.S. Environmental Protection Agency's (EPA's) ISC model (Bowers et al, 1979) was used to model the emissions from the OWMC facility for the annual and summer periods of construction and operation. The ISC model combines various dispersion model algorithms into a program that can be used to assess the air quality impact of emissions from several source types associated with an industrial complex. The long-term version of the model (ISCLT), which was used, is a sector averaged model. It uses statistical wind summaries to calculate seasonal or annual ground level concentration values using either a polar or Cartesian receptor grid.

Major features include variable mixing height with stability, wind velocity vertical profile, plume rise as a function of downwind distance, and provisions for treatment of stack tip downwash and pollutant decay and deposition. If one or more of these options is not specified by the user, the program assigns preselected default values and, in fact, for regulatory applications in the U.S., the default values for these options are generally recommended (Bowers et al, 1979).

The default values given in ISCLT for the change of wind speed with height were used. This is a function of atmospheric stability. Also, the rural mode of the model was used. Terrain adjustment was not included due to a lack of any significant topographic features near the proposed facility.

The dispersion modelling exercise required historical, hourly wind observations and other meteorological data from which Pasquill stability class frequencies could be determined. Hourly meteorological records (STAR analyses) from the St. Catharines and Mt. Hope stations were obtained, covering a period 1977 to 1986 (AES, 1987). Mean mixing heights were obtained from Environment Canada (1976). In this study, STAR data input to ISCLT was the synthesized site dispersion climatology as described in Appendix G. The modelling was performed out to a radius of 20 km in the case of stack emissions, and out to a radius of 5 km for fugitive emissions.

The ISCLT model treats the dispersion of each point source of emissions as a Gaussian plume, in which the concentration of a contaminant in the plume follows a normal distribution or "bell" curve in both the vertical and crosswind directions. Hourly concentrations are calculated at any point downwind as a function of source configuration, meteorological parameters, i.e., wind speed, atmospheric stability class (from the Pasquill-Gifford curves for stability classes A to F) (Turner, 1970), and mixing height, and averaged over the appropriate time period

(annual or seasonal). Briggs' plume rise equations are used. A wind profile exponent law is used to adjust the observed wind speed from the measurement height to the plume height. The effective height of release for stack emissions is determined from the physical height of release plus a plume rise due to the buoyancy and momentum of the flue gases (Bowers et al, 1979). Deposition was not considered in the analysis.

The ISCLT area source model is based on the equation for a finite crosswind line source. Individual area sources are required to have the same north-south and east-west dimensions; an irregular shape is represented by multiple squares. A visual distance is added to the actual downwind distance (as a function of the width of the area source) for the calculation of the vertical plume spread (Bowers et al, 1979).

K-3 SHORT-TERM DISPERSION MODELLING

Hourly concentrations were calculated with the use of the basic short-term (10 minute to 1-hour) Gaussian plume model (Turner, 1970). Conditions for a specific hour are assumed, and can be calculated as follows.

The concentration, X, of gas or aerosols at a receptor x, y, z from a continuous point source with an effective emission height, H, is given below. H is the height of the plume centreline when it becomes essentially level (sum of plume rise and stack height).

$$X = \frac{Q}{2\pi\sigma_y\sigma_z u} \exp -1/2 \left(\frac{y}{\sigma_y}\right)^2$$

$$\exp -1/2 \left(\frac{z-H}{\sigma_z}\right)^2 + \exp -1/2 \left(\frac{z+H}{\sigma_z}\right)^2$$

The plume spread has a Gaussian distribution (or normal distribution as depicted by a bellshaped curve) in both the horizontal and vertical planes, with standard deviations of plume concentration distribution in the horizontal and vertical of σ_y and σ_z, respectively; u is mean wind speed (m/s); Q is emission rate (g/s); and it is assumed that no deposition or reaction takes place on earth's surface (Turner, 1970).

The values of σ_y and σ_z vary with the turbulent structure of the atmospheric, height above the surface, surface roughness, sampling time over which the concentration is to be estimated, and distance from the source. Values of σ_y and σ_z are estimated from the stability of the atmosphere, which in turn is estimated from the wind speed and either incoming solar radiation or cloud cover. Pasquill Stability categories A to F (listed below) range from most unstable (A) to most stable (F). The neutral Class D can be assumed for overcast conditions during day or night, regardless of wind speed (Turner, 1970).

Surface Wind Speed (at 10 m) m/s	Day: Incoming Solar Rad'n			Night	
	Strong	Moderate	Slight	Thinly Overcast or ≥ 4/8 Low Cloud	≤ 3/8 Cloud
<2	A	A-B	B		
2-3	A-B	B	C	E	F
3-5	B	B-C	C	D	E
5-6	C	C-D	D	D	D
>6	C	D	D	D	D

This method can be used to give representative indications of stability over open country or rural areas (Turner, 1970).

Estimates of σ_y and σ_z as a function of downwind distance, x, can be estimated from Figures K-1 and L-2 (Turner, 1970).

Due to scientific and technical limitations inherent in these calculations, the use of the Gaussian plume model may provide best estimates but not infallible predictions. In most cases the concentrations predicted should be correct to within a factor of 3 (Turner, 1970).

When dealing with the diffusion of air pollutants in areas having a large number of sources, there may be too many sources of most atmospheric contaminants to consider each source individually. Often, an approximation can be made by combining all of the emissions in a given area and treating this area as a source having an initial horizontal standard deviation σ_{yo}. A vertical distance, x_y, can then be found that will give this standard deviation (values will vary with stability). Then equations for point sources may be used. This procedure treats the area source as a crosswind line source with a normal distribution, a fairly good approximation for the distribution across an area source. The initial standard deviation for a square area source can be approximated by $\sigma_{yo} \approx s/4.3$ where s is the length of a side of the area (Turner, 1970).

Concentrations downwind of a continuously emitting infinite line source such as a road or highway can be expressed by rewriting the basic Gaussian equation (expressed previously in this section).

$$X = \frac{2Q}{2 \Pi \sigma_z u} \exp \left\{ -1/2 \left(\frac{H}{\sigma_z} \right)^2 \right\}$$

when the wind direction is normal to the road. (Q = source strength in g/s m). This equation only considers the vertical dispersion parameter since it is assumed that lateral dispersion from one segment of the line is compensated by dispersion in the opposite direction from adjacent segments. Also, the y term does not appear in this equation as concentration at any given x is the same for any value of y (Turner, 1970).

The Ministry of the Environment have established point-of-impingement standards for 100 pollutants, to be regulated in accordance with concentration calculations outlined in Regulation 308. The concentration of a pollutant at a point-of-impingement is calculated in one of three ways, depending on the characteristics of the point of emission. Calculation (a) would be applied if the point-of-impingement were located on a building or structure on which the point of emission is located, or is within 5 m horizontally of the building or structure from which the emission originates, and, the height above grade at the point of emission is less than twice the height of the highest part of the building or structure on which the point of emission is located where the highest part of the building or structure is at a height of not more than twenty metres above grade or the height of the highest part of the building or structure on which the point of emission is located is greater than twenty metres above grade and the point of emission is less than twenty metres above the highest part of the building or structure on which it is located (see Appendix B) or, there is a building or structure upwind from the point of emission such that:

- the height above grade of the building or structure is greater than the height above grade at the point of emission, and

- the building or structure is a horizontal distance of 100 metres or less from the point of emission (see Appendix B).

In this case, the following formula shall be applied:

$$K = \frac{0.6 \times 10^6 \times Q}{L^2}$$

Where:

K is the half hour average concentration at the point of impingement in micrograms per cubic metre.

Q is the rate of emission in grams per second of the contaminant.

L is:

- where the point of impingement is at the same height or higher above grade than the point of emission, the straight line distance in metres between the point of emission and the point of impingement, or

- where the point of impingement is lower in height above grade than the point of emission, the product of 1.57 and the straight line distance in metres between the point of emission and the point of impingement.

This option was not considered in the OWMC analysis (to date) as concentrations have been limited to off-site receptors only.

Calculation (b) is applied if the point of impingement is a horizontal distance of 5 m or more from the building or structure on which the point of emission is located, and, the height above grade at the point of emission is less than twice the height of the highest part of the building or structure on which the point of emission is located where the highest part of the building or structure is at a height of not more than twenty metres above grade (see Appendix B), or the height of the highest part of the building or structure on which the point of emission is located is greater than twenty metres above grade and the point of emission is less than twenty metres above the highest part of

the building or structure on which it is located (see Appendix B), or there is a building or structure upwind from the point of emission such that:

- the height above grade of the building or structure is greater than the height above grade at the point of emission, and

- the building or structure is a horizontal distance of 100 metres or less from the point of emission (see Appendix B).

These postulates apply to most of the area sources on site. The following formula should be applied:

$$K = \frac{10^6 \times Q \times F}{31.4 \times \sigma_y \times \sigma_z} \times \exp\left\{-1/2\left(\frac{Y}{\sigma_y}\right)^2\right\}$$

$$\times\left\{\exp\left\{-1/2\left(\frac{Z-H}{\sigma_z}\right)^2\right\} + \exp\left\{-1/2\left(\frac{Z+H}{\sigma_z}\right)^2\right\}\right\}$$

Where:

K is the half hour average concentration of the contaminant at the point of impingement in micrograms per cubic metre

Q is the rate of emission in grams per second of the contaminant

exp is the exponential function where e = 2.7183

Y is the perpendicular distance in metres between the point of impingement and a vertical plane parallel to the chosen direction of the wind through the wind-oriented centre of the building or structure on which the point of emission is located (Appendix B)

Z is the difference in height, in metres, between the point of impingement and the ground level at or beneath the point of impingement

H is a function of the height, in metres, above grade of the building or structure on which the point of emission is located

F is a factor related to the atmospheric stability of the air

σ_y is a function which defines the amount of dispersion of the contaminant in a horizontal direction at the point of impingement

σ_z is a function which defines the amount of dispersion of the contaminant in a vertical direction at the point of impingement

The concentrations are calculated for C and D Stability classes (from the Pasquill-Gifford dispersion coefficient curves), and assume a wind speed of 5 m/s. For additional details on the determination of σ_y and σ_z, see Appendix B.

If the source is not affected by any of the conditions listed above (as for example, a stack greater than 20 m above the maximum building height), the formula in condition (c) is applied as follows:

$$K = \frac{10^6 \times Q \times F}{6.28 \times \sigma_y \times \sigma_z \times U} \times \exp\left\{-1/2\left(\frac{Y}{\sigma_Y}\right)^2\right\}$$

$$\times\left\{\exp\left\{-1/2\left(\frac{Z-H}{\sigma_z}\right)^2\right\} + \exp\left\{-1/2\left(\frac{Z+H}{\sigma_z}\right)^2\right\}\right\}$$

Where:

K is the half hour average concentration of the contaminant at the point of impingement in micrograms per cubic metre

Q is the rate of emission in grams per second of the contaminant

U is the wind speed in metres per second

exp is the exponential function where e = 2.7183

Y is the straight line distance in metres between the point of impingement and a vertical plane through the point of emission in the chosen direction of the wind (Appendix B)

Z is the difference in height, in metres, between the point of impingement and the ground level at or beneath the point of impingement

H is the effective height of the emission of a contaminant

F is a factor related to the atmospheric stability of the air

σ_y is a function which defines the amount of dispersion of the contaminant in a horizontal direction at the point of impingement

σ_z is a function which defines the amount of dispersion of the contaminant in a vertical direction at the point of impingement

The Holland plume rise formula is used to determine H, as follows:

$$H = h + \frac{v_s d}{u} \times 1.5 + 2.68 \frac{(T_s - 283)d}{T_s}$$

Where:

h is the height above grade in metres, of the point of emission

v_s is the speed in metres per second in an upward vertical direction of the contaminant gas stream at the point of emission to the atmosphere (see Appendix B)

d is the diameter in metres of a circle of equivalent area to that area through which the contaminant gas stream enters the air

u is the speed of the wind in metres per second (see Appendix B)

T_s is the temperature in degrees Kelvin (273° + temperature in Degrees Celsius) of the contaminant gas stream at the point of emission

Concentrations are calculated assuming both C and D stability classes (see Appendix B), with the maximum value assumed. The incinerator and evaporator stacks were modelled using this method.

The final section in Regulation 308 (Section (d)) deals with the emissions of a contaminant from more than one source, in which case the contaminant concentrations at the point of impingement, resulting from all sources, shall be added together to give an aggregate value for K. This is to be performed for all wind speeds and wind directions and the largest value is to apply to this Regulation.

For conditions not considered within the Ontario Ministry's Regulation 308 (for example, stability classes other than C and D and wind speeds other than 5 m/s) the Gaussian plume equations discussed in Turner's handbook (Turner, 1970), and provided at the beginning of this section, were used.

K-4 REFERENCES

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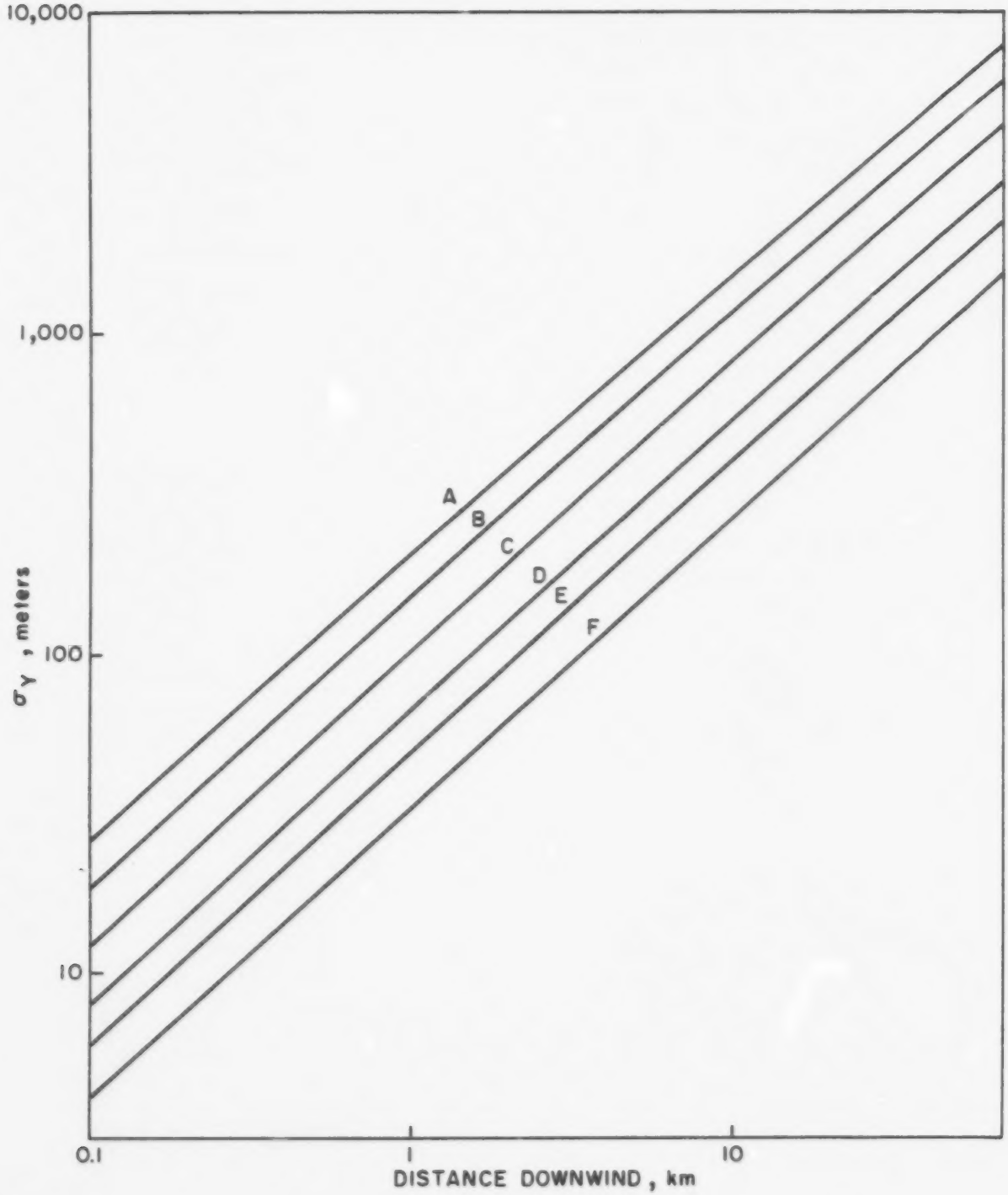
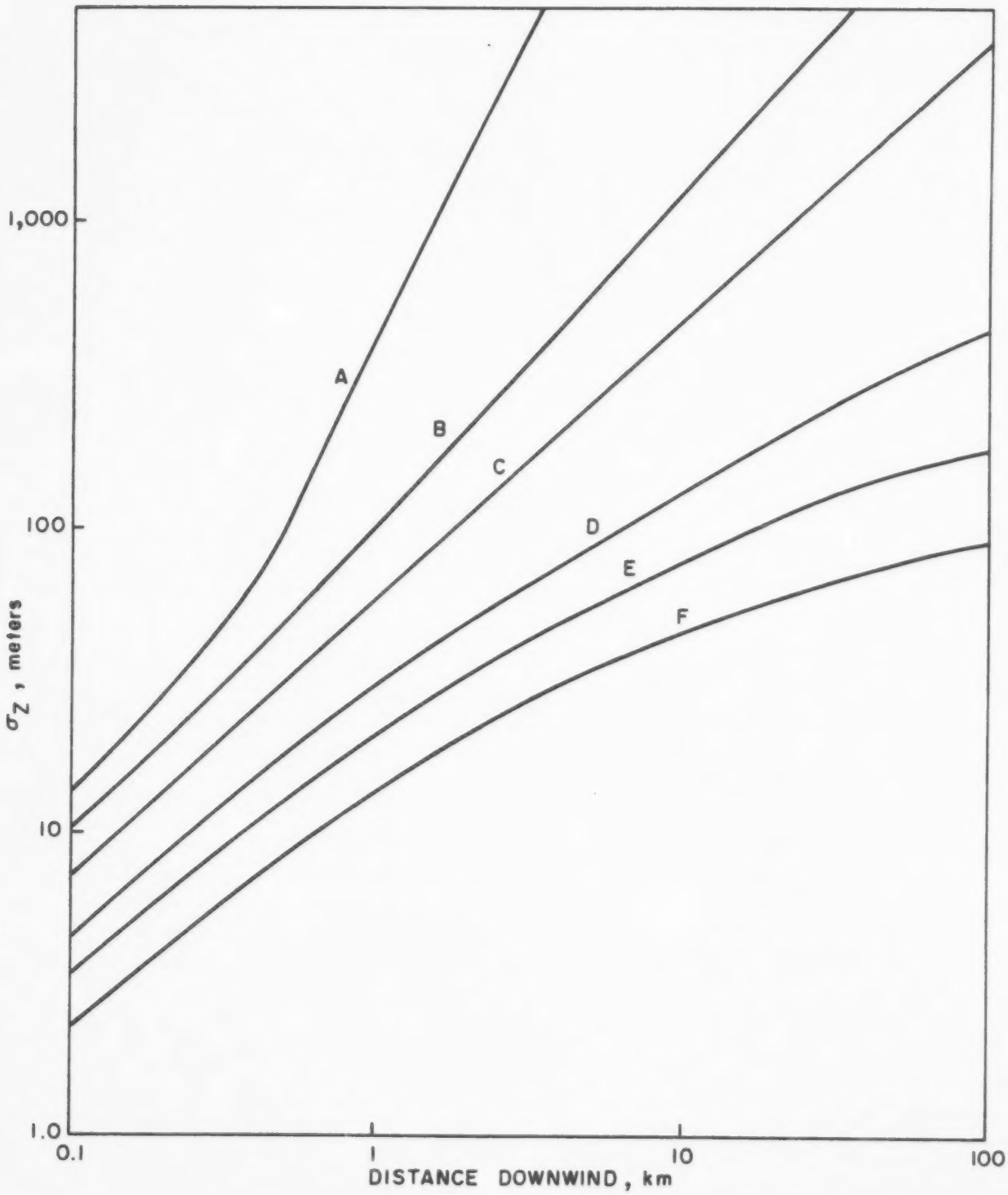
FIGURE K.1



HORIZONTAL DISPERSION COEFFICIENT AS A FUNCTION OF DOWNWIND DISTANCE FROM THE SOURCE. (PASQUILL - GIFFORD)

FIGURE K.2



VERTICAL DISPERSION COEFFICIENT AS A FUNCTION OF DOWNWIND DISTANCE FROM THE SOURCE . (PASQUILL - GIFFORD)

APPENDIX L

PROPOSED MONITORING PROGRAM AT THE OWMC PREFERRED SITE IN WEST LINCOLN

L-1 INTRODUCTION AND PURPOSE

This appendix provides an outline of the ongoing air quality and meteorological baseline monitoring program (June, 1986 to May, 1987) for the Ontario Waste Management Corporation's (OWMC's) proposed facility in the Township of West Lincoln, as well as a summary of proposed activities during subsequent pre-construction, construction and operational phases of the facility development.

The proposed OWMC facility will treat both organic and inorganic industrial wastes. Organic wastes will be thermally destroyed in a rotary kiln incinerator, and the inorganic wastes rendered stable and non-toxic by physical/chemical treatment processes. Ash from the incinerator flue gas treatment system and solidified residues from the physical/chemical treatment plant will be disposed of in an engineered landfill (Monenco, 1987).

An important source of contaminant emissions to the atmosphere is the incinerator stack. Emissions will include acid gases, such as sulphur dioxide, nitrogen oxides and hydrogen chloride, trace metals, various organic compounds and particulate matter. As well, fugitive emissions released at or near ground level can be expected from other components of the facility. These will include low levels of volatile organics released from liquid waste handling, storage and distribution, and the physical/chemical treatment plant. Fugitive emissions of particulate matter can also be expected. Some potential sources are: physical/chemical treatment, incinerator ash handling, landfilling, vehicular traffic and construction activities.

The above emissions should be controlled to the fullest extent possible through the engineering design and operational procedures. Indeed, studies to date (see Monenco, 1987, Environ, 1987) and the work of this study (Chapter 5) indicate that under normal conditions, emissions will occur at levels well below those allowable under Ontario's air quality regulations and will not represent a significant risk to human health. Nevertheless, the presence of a wide range of hazardous substances at the facility and the potential for their release into the atmosphere necessitates a comprehensive program of air quality and meteorological monitoring.

The air quality and meteorological monitoring program fulfills a number of purposes, firstly, in the context of the environmental impact assessment (EA) of the proposed facility and, secondly, in the context of the subsequent construction and actual operation of the facility. For the EA, site-specific monitoring data are needed to supplement available information in order to:

- describe existing air quality conditions at the OWMC site for comparison with the air quality impacts that may be associated with the construction and operation of the proposed facility, and

- document the dispersive capacity of the local atmosphere in sufficient detail to undertake the required predictive modelling of atmospheric emissions

- confirm information used in the Phase 4A site selection studies

The monitoring program conducted primarily for the purposes of the EA is termed a baseline program (completed May, 1987 at the West Lincoln site).

Monitoring during the periods following the conclusion of the baseline program through construction and operation is needed to:

- provide further information on existing or background air quality conditions for comparison with the impacts which may be measured during construction and operations,

- provide an independent assessment of actual effects on air quality and to ensure that these are within regulated limits and any applicable conditions of approval of the project established by the Ministry of Environment and the Environmental Assessment Board

- demonstrate to the public a firm commitment to document and minimize any impact that might occur and provide a factual basis for the continuing dialogue with the community on local air quality issues

- provide information that can be used in making future decisions on changes in the design and operations of the facility

- provide data for emergency response in the event of an accidental spill or release

The required data for these purposes will be collected primarily during the construction and operational monitoring programs. However, a reference data base documenting existing conditions prior to construction or operations is also needed. This is comprised of data collected during the baseline monitoring program and relevant additional data collected before and during construction.

L-2 GENERAL APPROACH

As discussed above, it is expected that air quality and meteorological monitoring at the West Lincoln site will be conducted in four phases:

- baseline
- pre-construction
- construction (including pre-operational)
- operational

The parameters measured, methods of measurement, monitoring locations and monitoring frequencies will vary between phases, depending on the purposes to be fulfilled. The following sections provide the general scope of the monitoring programs in each phase, as currently envisioned. A summary is provided in Figure L-1.

L-2.1 BASELINE PROGRAM

One air quality and meteorological monitoring station was established on the OWMC preferred site at West Lincoln. This program extended for a period of one year (June 1986 to May 1987). The more common air pollutants, or "criteria" pollutants, were measured continuously. These are:

- sulphur dioxide (SO_2)
- nitrogen oxides (NO and NO_2)
- ozone (O_3)
- total reduced sulphur (TRS)
- total hydrocarbons (THC)

In addition, the following were monitored for 24-hour periods every third day:

- total suspended particulate (TSP)
- fine particulate (FP)

Certain trace metals, inorganic and organic compounds were being measured periodically by cumulative 24-hour sampling. These have the potential to be emitted from the proposed OWMC facility and are considered to be potentially hazardous constituents of the emissions. These include arsenic, chromium, mercury, lead, fluorides, chlorides, PCB's, chlorophenols, chlorobenzenes, chlorinated pesticides and herbicides, PAH's, formaldehyde and cyanide. Exploratory measurements of dioxins and furans were undertaken. Available sampling and analytical techniques have a limit of detection very near to these which prevail in ambient air. Therefore it was questionable whether any meaningful results would emerge. As well, a scan of over 70 other organic compounds which may be present in the waste received at the facility, and thus potentially emitted from the incinerator stack or as volatile fugitive emissions, was conducted for one day in each of three seasons by the mobile TAGA 6000. Wet/dry deposition was measured on a monthly basis and analyzed for trace metal constituents.

The following meteorological parameters were measured continuously on a 30 m tower located at the monitoring site:

- wind speed (at 10 m and 30 m above ground level)
- wind direction (at 10 m and 30 m above ground level)
- air temperature (at 10 m and 30 m above ground level)
- solar radiation (at 10 m above ground level)

In addition, rainfall and snowfall were measured and there were periodic special meteorological studies each season to measure representative mixing height and upper air stability and wind conditions using minisondes.

The continuously recorded air quality and meteorological parameters were collected and telemetered automatically to the ORF (Ontario Research Foundation) computers.

L-2.2 PRE-CONSTRUCTION PROGRAM

This will be a period of much reduced monitoring effort following the conclusion of the baseline program and preceding major construction activity. However, it is expected that the monitoring station and tower will be retained and the continuously recorded parameters will continue to be measured and telemetered automatically to ORF (SO_2, NO, NO_2, O_3, TRS, CO, wind speeds, wind directions, air temperatures and solar radiation). In addition, TSP and FP would be measured every 6 days (instead of every 3 days, as in the baseline program). This will extend the data base on existing conditions for these basic parameters at minimal cost, allowing the documentation of year-to-year variations in conditions which could not be captured in the one-year baseline program. Continuing to operate the instruments will also avoid the additional costs and problems associated with de-commissioning the monitoring station and then re-commissioning at a later date.

L-2.3 CONSTRUCTION PROGRAM

This program will begin at the commencement of major site clearing. It will consist of two parallel monitoring activities, one designed to monitor the impacts of construction, and the other being a continuation of the baseline and pre-construction program and designed to enhance the data base on existing conditions relevant to emissions expected during operation of the facility (termed pre-operational monitoring).

a) Construction Monitoring

The primary emphasis will be on monitoring dust levels during construction. TSP and FP will be measured at the existing baseline monitoring station plus one other location, probably at the NE edge of the site. These will be supplemented by two other TSP samplers at other points around the site boundary and a number of dustfall monitors. The 24-hour TSP and FP samplers will normally be collected every third day, as in the baseline program. However, consideration will be given to collecting daily samples during periods of greatest potential dust generation, e.g., site clearing and major excavations. Dustfall will be measured as 30-day accumulations.

b) Pre-Operational Monitoring

This will begin one year prior to scheduled start-up of the facility. However, in advance of this, the established baseline monitoring station will continue to operate, as in the pre-construction program (with the exception of TSP and FP measurements, which will be at the increased intensity required for construction monitoring, as noted above).

Currently, it is anticipated that two monitoring stations will be established for pre-operational monitoring (and subsequently for the operational program), in addition to the existing baseline station. These will be located at the NE edge of the site and at an off-site location where the maximum impact of incinerator stack emission is expected, i.e., about 2 km NE of the site. The three stations will continuously measure the "criteria" pollutants, i.e., SO_2, NO and NO_2, O_3, CO, and TRS. TSP and FP will be measured every third day (or more frequently, as required for construction monitoring). A third FP monitor would be added for pre-operational monitoring. Wet deposition will be measured monthly. A limited program of periodic cumulative measurements of organic compounds and metals (as in the baseline program) and a background odour evaluation will be considered.

In addition, it is proposed that either a mobile TAGA unit or a more conventional gas chromatograph with a mass selective detector (GC/MSD) will begin operation during this period and collect additional data on background levels of organic compounds around the site (a detailed design and protocol for this component of the survey will be developed). This mobile facility would be a major feature of OWMC's ongoing monitoring program for both routine emissions and specific investigations during operation of the facility. It would supplant much of the periodic cumulative monitoring and TAGA surveys which might otherwise be required.

Continuous monitoring of meteorological variables (wind speed, wind direction, temperature, solar radiation) will continue at the existing monitoring station. Rainfall and snowfall will also be monitored. These measurements, together with the continuous air quality measurements at the three stations, will

continue to be telemetered automatically to the ORF computer. In addition, at some suitable time in the construction schedule, real time data reporting could be implemented at the OWMC facility.

The pre-operational monitoring will serve to confirm existing air quality conditions around the OWMC site and will provide an opportunity for "shakedown" of new instrumentation before the facility begins operation. Also, at this stage, improvements and additions to the monitoring program arising out of MOE, peer and public reviews, the decision of the Environmental Assessment Board and internal OWMC deliberations would be implemented. Thus, at the end of pre-operational monitoring, a generally accepted and fully operational system of air quality and meteorological monitoring should be in place in readiness for the opening of the OWMC facility.

L-2.4 OPERATIONAL MONITORING

Operational monitoring will have to be co-ordinated with OWMC operations staff and engineering consultants. However, it is anticipated that an intensive one-year period of operational monitoring will be carried out, consisting of the following major components.

- continuous monitoring of "criteria" pollutants at the three monitoring stations (SO_2, NO and NO_2, O_3, CO, TRS and total hydrocarbons (THC)), plus 24-hour TSP and FP every third day at each station and monthly wet deposition

- periodic monitoring for trace metals and organic compounds, including use of a mobile trace for organic monitoring facility

- periodic odour evaluations, probably based on a combination of analytical and sensory techniques

- continuous monitoring of meteorological variables (wind speed, wind direction, air temperature, solar radiation) as well as rainfall and snowfall at the existing monitoring station

- continuous monitoring of incinerator stack emissions for such critical parameters as opacity, THC, CO, NO_x, and HCl, as well as temperature and velocity of the flue gases (to be addressed by Monenco Ltd.)

In addition, it is anticipated that a number of incinerator test burns will take place (number to be determined) During these tests additional monitoring will be required of both the incinerator flue gases and ambient air. This would include:

- sampling and analysis of the designated principal organic hazardous compounds (POHC's) in the flue gases and in the waste feed

- sampling and analysis of a range of products of incomplete combustion (PIC's), e.g., dioxin and furans, PAH's, and precursor compounds, such as chlorobenzenes and chlorophenols, in the flue gases

- sampling and analysis of particulate matter, acid gases and trace metals in the flue gases

- intensive monotoring for trace metals and organic compounds in ambient air upwind and downwind of the plant during test burns

- upper air meteorological measurements, using minisondes, of wind, temperature, mixing height and atmospheric stability

After the one-year intensive monitoring period and test burns, a much reduced monitoring program would continue for the life of the facility. It is suggested that this consist of:

- continuous monitoring of critical parameters in the incinerator flue gases (e.g., opacity, THC, CO, NO_x, HCl)

- periodic monitoring for organic compounds in ambient air using the mobile monitoring facility

- continuous monitoring of meteorological parameters at the existing monitoring station (needed primarily to support emergency response measures in the event of a spill or process upset)

- continuous monitoring of "criteria" pollutants at one monitoring station to ensure that levels are consistent with regional trends and that pollutant contributions from the OWMC facility do not increase significantly.

Further, more intensive studies may be required from time to time to respond to particular concerns or in association with major changes in the design or operation of the facility, for example, when a second incinerator is added.

L-3 MONITORING PARAMETERS

L-3.1 AIR QUALITY

The choice of air quality monitoring parameters is normally determined by the contaminants of primary interest which are expected to be emitted from the facility. Such emissions could be from the incinerator stack or, as fugitive emissions, from a number of points in the general plant area, including the landfill. As well, other air quality parameters may be chosen to reflect the general level of air quality at the site, before or after the facility begins operations. For example, it may be desirable to record concentrations of ozone and, in a farming area, odour levels and concentrations of certain herbicides and pesticides in the air, even though these may not be emitted from the facility at all or may be emitted in only trace amounts.

Since, by the very nature of an industrial waste treatment facility, the list of potential emissions is lengthy, some selectivity is required in order to arrive at a practical monitoring program. Selection of the contaminants and the intensity of sampling may be based on the following criteria:

- regulatory requirements
- significance of the emission, in terms of its quantity <u>and</u> its toxicity,

- availability of practical and proven sampling and analytical methods for the concentrations present,

- significance as an indicator of the presence of other contaminants and of general air quality conditions and trends,

- significance as an indicator of facility performance, e.g., of incinerator destruction efficiency, and

- public input

Following is a list of potential monitoring parameters under the headings acid gases, metals, organics and others. The list is based primarily on contaminants measured in the stack emissions from existing industrial waste incinerators and the composition of waste feeds:

Acid Gases

Hydrogen Chloride
Hydrogen Fluoride
Nitrogen Oxides
Sulphur Dioxide

Metals

Antimony
Arsenic
Beryllium
Cadmium
Chromium
Cobalt

Copper
Lead
Manganese
Mercury
Nickel
Selenium
Tellurium
Thallium
Vanadiun
Zinc

Others

Carbon Monoxide
Odour
Ozone
Particulate Matter
Total Hydrocarbons

Organics*

Acetronile
Anthracene
Aniline
Aldrin
Benzo-[a]-pyrene
Benz-[a]-anthracene
Bromine
Boron Trifluoride
Bromochloromethane
Benzene
Bromodiochloromethane
Hydrogen cyanide
Hexachlorobenzene
Hexachloroethane
Hexamethyl phosphoramide
Hydrazine
Heptaclor
Lindane
Methanine diphenyl di-isocyanate
Methylene dianiline
Manganese cyclopentadienyl tricarbonyl

Bromomethane
Bromoform
Chloromethyl methyl ether
1-Chloro-2-3 epoxy propane
Carbon tetrachloride
Carbon disulphide
Chloroform
Chlorobenzene
O-chlorophenol
Chrysene
Chlordane
1,1 Chloromethyl ether
2-Chloromethyl ether
Diborane
2,4-D
Decarborane
Dibenz-[a-h]-anthracene
Diazinon
1,1-Dichloromethyl ether
Dibromochloromethane
2,4-Dimethyl phenol
Dimethyl sulphide
Diethyl phthalate
Dichlorobenzenes
Dioxins
3,3-Dichlorobenzidine
3,3-Dimethoxybenzidine
Dieldrin
Dichloroethane
1,2-Dichloroethane
Dioxane
1,2-Dibromoethane
Methyl ethyl ketone
Methylene chloride
Methylene bromide
Methyl chloride
Methyl bromide
Methoxychlor
Mercaptans
Mirex
Naphthalene
O-nitrophenol
N-nitro-dimethylamine
Phenol
Pentachlorophenol
Phosgene
Pyrene
Polychlorinated biphenyls
Pyridine
Pentaborane
Perchloroethylene
Styrene
Tetrachloroethylene
1,1,1-Trichloroethane
Toxaphene
Toluene
2,4,5-T
2,4,6-Trichlorophenol
Trichlorobenzene
Trichloroethylene
Toluene di-isocyanate
Tetra ethyl lead
Vinyl chloride
Vinylidene chloride

Ethylene throurea
Ethylene
Endrin
Ethyl Acrylate
Freon 12
Fluoranthene
Freon 11
Furans
Formaldehyde
Xylene

* The list of organic compounds is not intended to be an exhaustive compilation of all potential constituents of the waste feeds and air emission. However, it is suggested as a basis for the selection of monitoring parameters.

L-3.2 METEOROLOGY

In this application, meteorological measurements are made primarily for the purpose of predicting, and understanding, the transport and dispersion of airborne emissions. Thus, the parameters of interest are:

- wind speed
- wind direction
- atmospheric stability (vertical temperature profile)
- temperature
- mixing height

In relatively homogeneous terrain, such as that found around the OWMC preferred site in West Lincoln, spatial variations are not expected to be great enough to significantly alter dispersion conditions. However, vertical variations, e.g., between ground level and the level of the incinerator stack plume, can be large. Therefore, upper air measurements are needed to supplement measurements near the ground.

L-4 REFERENCES

Environ Corp., 1987, "Phase 4B: Site Assessment - Risk Assessment", in preparation for Ontario Waste Management Corporation.

Monenco, 1987, "Facility Characteristics Report - Phase 4B", in preparation for Ontario Waste Management Corporation.

Phase	Year 0	1	2	3	4	5	6	7	Monitoring Parameters
Baseline	_____								Continuous at one station: SO_2, NO, NO_2, O_3, TRS Every 3rd day: TSP, FP (at one site) Periodic cumulative sampling: metals, inorganics, organics Every season: TAGA scan for organics Monthly wet deposition, incl. metals Continuous met. parameters: wind speed & dirn., temp. (two levels) solar radn, rainfall, snowfall Special met. studies every season
Pre-Construction	_____								Continuous at one station: SO_2, NO, NO_2, O_3, TRS Every 6th day: TSP, FP (at one site) Continuous met. parameters: wind speed & dirn., temp. (two levels) solar radn.
Construction	Const. Monit._____								Every 3rd day (daily at times): TSP (at 4 sites), FP (at 2 sites) 30-day dustfall at various sites Continuous at one station: SO_2, NO, NO_2, O_3, TRS Continuous met. parameters: wind speed & dirn., temp. (two levels) solar radn., rainfall and snowfall
		Pre-Op Monit. _____							IN ADDITION TO CONSTRUCTION MONITORING (above): Continuous at two other stations: SO_2, NO, NO_2, O_3, TRS, FP at a 3rd site Periodic cumulative sampling: metals, inorganics, organics Mobile GC/MSD surveys for organics Monthly wet deposition, incl. metals Background odour evaluation
Operational					_____				Continuous at three stations: SO_2, NO, NO_2, O_3, TRS, THC, CO Every third day: TSP, FP (at 3 sites) Periodic cumulative sampling: metals, inorganics, organics Mobile GC/MSD surveys for organics Monthly wet deposition, incl. metals Odour evaluation Continuous met. parameters: wind speed & dirn., temp. (two levels) solar radn., rainfall and snowfall Continuous monitoring of critical parameters at stack (see text) TEST BURNS, including special stack sampling, ambient air monitoring and meteorological measurements (see text)
						_____			Continous at one station: SO_2, NO, NO_2, O_3, TRS, THC, CO Every 6th day: TSP, FP (at one site) Periodic surveys with mobile GC/MSD Continuous met. parameters: wind speed & dirn., temp. (two levels), solar radn., rainfall and snowfall Continuous monitoring of critical parameters at stack More intensive studies as required

FIGURE L.1

SUMMARY OF AIR QUALITY AND METEOROLOGICAL MONITORING PROGRAM

APPENDIX M

INCINERATOR EMISSIONS

M-1 INTRODUCTION

The purpose of this Appendix is to identify and quantify, by reference to design data submitted by OWMC's incinerator consultant and to test data on other rotary kilns, potential emissions to the atmosphere from the incinerator component of the integrated industrial waste management facility proposed by the Ontario Waste Management Corporation (OWMC). Consideration is limited to expected routine emissions and does not include emissions which may result from process upsets. Data in this appendix will assist in evaluating the impacts of air emissions from the proposed facility.

M-2 SOURCE IDENTIFICATION AND EMISSION CHARACTERIZATION

M-2.1 POTENTIAL EMISSION TYPES AND SOURCES

The proposed OWMC facility, which will treat industrial waste that cannot be dealt with by conventional treatment facilities. Conventional treatment facilities are municipal sewage treatment plants, municipal incinerators and municipal landfills. The "special waste" to be treated by the proposed facility is both organic and inorganic. Organic wastes are to be destroyed by thermal destruction in a rotary kiln incinerator. The inorganic wastes are to be rendered stable and non-toxic by physical/chemical treatment processes. Treatment residues would be solidified and disposed of in an engineered landfill with incinerator ashes. A simple schematic of a typical integrated hazardous waste treatment facility is shown in Figure M.1, together with the potential sources of air emissions associated with each process. This appendix specifically addresses the incinerator component of the facility.

The rotary kiln incinerator is one of the major potential sources of emissions. A high destruction/removal efficiency would limit the quantities of contaminants released from a stack to the atmosphere to trace levels.

Present descriptions and estimates of hazardous wastes to be treated by the facility are not sufficiently detailed to identify all individual contaminants which may be released during incineration. However, in order to organize a general inventory of potential waste

contaminants, four classes of organic and inorganic chemicals characteristic of hazardous waste were defined. These classes are acid gases, metals, organics and others which includes primary pollutants.

In the following sections of this chapter, information on waste incineration, with emphasis on thermal destruction and the associated emission of organic and inorganic contaminants, including acid gases and metals, is discussed. Studies of thermal destruction efficiencies and contaminant emissions specific to special organic wastes and operating rotary kiln incinerators are also referenced.

M-2.2 INCINERATOR STACK EMISSIONS FROM OPERATING FACILITIES

M-2.2.1 INTRODUCTION

The prime objective of incineration of wastes is to thermally destroy organic compounds. When combustion is complete, nitrogen oxides, acid gases, such as hydrogen chloride, and metals and salts may be emitted. Nitrogen oxides are a product of the high temperature combustion reaction which oxidizes the nitrogen present in the organic waste feed and combustion air. The acid gases, metals and salts are inorganic contaminants which are incapable of being thermally destroyed but are oxidized, vapourized or unaltered by the combustion process. If combustion is incomplete, partially oxidized organic compounds, carbon monoxide, polycyclic aromatic hydrocarbons and other higher molecular weight chlorinated reaction products such as dioxins may be emitted.

General experience in the incineration of hazardous waste, waste oil, municipal waste, sewage sludge and fossil fuels provides information

on the behaviour of organic wastes which undergo combustion. This full range of combustion experience can be used to supplement the information specific to rotary kiln waste incineration. Table M-1 outlines the characteristic air pollutants that arise from the combustion of wastes. Most of these air pollutants have been cited in incinerator studies in both the U.S. and Europe (Fabian et al., 1979; Brady, 1982; Buekens and Jacob, 1982; Fichtel, 1982; Seaverns et al., 1982; Gorman and Ananth, 1982; CARB, 1983; Trenholm et al., 1984; Kelly, 1985; Oberg et al., 1985; Oppelt, 1986).

M-2.2.2 THERMAL DESTRUCTION

Organic wastes will be thermally destroyed in a rotary kiln incinerator. This incinerator breaks down the molecules of the organic waste by means of high temperatures. Theoretically, during complete combustion, the organic waste is reacted with oxygen at high temperatures and forms carbon dioxide and water vapour, plus some combustion products such as nitrogen oxides and hydrogen chloride. Complete combustion depends not only on the characteristics and quantity of the waste feed but also on operating conditions, such as combustion zone temperature, residence time, amount of excess air, and degree of turbulence during combustion. The rotary kiln incinerator with secondary combustion is widely accepted as an efficient and flexible means of destroying large volumes of a variety of hazardous organic wastes in the form of sludges and solids, as well as liquids.

The primary performance standard for hazardous waste incinerators under the U.S. Resource Conservation and Recovery Act (RCRA) regulations is the attainment of 99.99% Destruction/Removal Efficiency (DRE) for hazardous organic compounds. In order to reduce the burden of analyzing all potentially hazardous compounds in a waste, the regulations stipulate that only certain organic compounds be tested to determine

compliance with the 99.99% DRE standard. These designated compounds are referred to as Principal Organic Hazardous Constituents (POHC's). The assumption is made that the POHC's are chosen such that, if 99.99% DRE is achieved for these compounds, then other organic compounds of concern in the waste will have a DRE of at least 99.99%. The USEPA has prepared a method of determining POHC's based on the quantity of the compound in the waste and the compound's heat of combustion (USEPA, 1983; Reed and Bierman, 1982). A group of three or four POHC's are usually selected, plus one or two other compounds based on sampling considerations or toxicity concerns.

Performance testing on a chemical rotary kiln incinerator which handles principally alcohols, alkanes, ketones, water, chlorinated compounds and aromatics illustrates several factors which affect the (DRE) (Austin et al., 1982). Kiln feeds had higher DRE's than secondary feeds (secondary feeds are introduced into the downstream secondary combustion chamber and have shorter residence times). Water soluble organic compounds in watery wastes had lower DRE's than water insoluble organic compounds. Waste mixtures with higher heat contents had higher DRE's. Increasing the combustion chamber temperature from 704°C to 871°C resulted in higher DRE's, although increasing it to 1010°C caused no further increase.

Experience from laboratory tests, trial burns and test programs on specific incinerators indicates that most toxic organic chemicals can be completely destroyed at 1000°C, with a residence time of 2 seconds (Shen et al., 1978). However, many wastes will completely decompose at lower temperatures and shorter residence times. More stable and persistent compounds such as polychlorinated biphenyls (PCB's), dichloro diphenyl trichloroethane (DDT), ethylene tars, and highly chlorinated chemical process waste require higher temperatures and longer residence times.

The USEPA has also prepared a regulatory impact analysis of hazardous waste incineration. As part of this study, data from tests at eight facilities have been assembled. These eight facilities covered a variety of incineration technologies and flue gas cleaning systems. Hazardous organic constituents were identified and quantified in the waste feeds and stack emissions to determine DRE's (Trenholm et al., 1984).

A large number of data points were gathered for many organic compounds. The organic compounds most often identified and the frequency with which each compound was found in 19 waste streams are shown in Table M-2. The frequency of occurrence of carbon tetrachloride and trichloroethylene are artificially high because these compounds were spiked into the wastes at most sites. Individual compound DRE's span a wide range. Thirty-five percent of the DRE's fall between 99.99 and 99.999%, 25% are above 99.999%, 20% are just below 99.99% and the final 20% are below 99.95%. These DRE's occurred for incinerator temperatures of 820°C-1100°C and residence times of 0.2-6.5 seconds.

The lowest DRE's occurred when one or both of two factors are present. First, lower DRE's result when organic contaminant concentrations in the waste are low (below 1000 μg/g). Second, lower DRE's tended to occur for organic compounds that were also identified as products of incomplete combustion. Thus, combustion mechanisms which produce organic compounds may offset thermal destruction processes with the net result that apparent destruction/removal efficiencies are lower than anticipated.

A number of products of incomplete combustion (PIC's) were also identified and quantified in the stack discharges (products of incomplete combustion were defined as compounds found in the stack effluent, but not found above 100 μg/g in the waste). Table M-3 lists products of incomplete combustion found in stack emissions from the survey of eight waste incinerators.

There are various theories on the origin of these PIC's. One is that they are formed in complex combustion reactions. A second is that the compounds are present in the waste feed below analytical detection levels, but are destroyed at relatively low DRE's and are detected in the stack emissions. A third possibility is that they may be introduced to the incineration system from some source other than the waste feed. Three possible external sources of organic compounds are the scrubbing liquid used in flue-gas treatment, ambient air introduced into the system and auxiliary fuel.

Current data suggest that for thermal destruction facilities which are achieving good POHC DRE, PIC emissions are also very low. Consequently, EPA does not currently have plans to regulate PIC's (Oppelt, 1986).

Rotary kiln incinerators are the preferred type of incinerators for destroying PCB containing wastes. This is because of their ability to handle both liquid and solid wastes either alone or in combination. The PCB rotary kiln incinerators have secondary combustion chambers after primary combustion in the rotary kilns. Operating temperatures are typically between 1100° and 1300°C. Gas-phase residence time in high temperature zones varies from less than one to several seconds. Three U.S. companies (Ensco, Rollins and SCA) operate full-scale, commercial stationary PCB destruction facilities. Trial burns for EPA certification of these rotary kilns for commercial PCB destruction demonstrate that this thermal destruction technology is capable of DRE's in excess of 99.9999% (ORF et al, 1986). In addition to these three United States companies, there are three European hazardous waste treatment operations which destroy PCB wastes with rotary kiln incineration. These are the Hessian Industrial Waste Inc. (HIM) in West Germany, Kommunekemi in Denmark and SAKAB in Sweden.

An extensive emission measurement program was conducted at the HIM hazardous waste treatment plant in Biebesheim, West Germany for the United States Environmental Protection Agency (USEPA) (Maurer, 1984). The Biebeshiem facility incinerates organic industrial wastes in a rotary kiln followed by secondary combustion and flue gas treatment. Destruction/removal efficiency (DRE) of organic wastes was one of the parameters studied during the Biebeshiem program. The DRE's of four types of organic wastes were investigated. The DRE's were as follows: diamines 99.997%, nuclear chlorinated benzoylchloride 99.999%, PCB's/ methylene chloride >99.999% and p-toluene sulphonic acid >99.999%. These DRE's were determined for kiln slag temperatures (temperature measured in the slag, not the gases) of 1100 to 1400°C.

In addition to the liquid PCB/methylene chloride incineration tests, condensers contaminated with PCB's were also fed into the incinerator and the DRE's evaluated. With kiln temperatures of approximately 1300°C, a DRE of >99.999% was measured.

During the last few years, considerable effort has been spent in studying emissions of polychlorinated dibenzo-p-dioxins (PCDD's) from incineration and combustion. In principle, there are three main sources which could account for the emission of PCDD's and polychlorodibenzo-furans (PCDF's), a related group of compounds, from waste incineration. These are:

i) The compounds are trace components of the waste feed and are not effectively destroyed.

ii) They are formed from chlorinated organic precursors -

- from chemically related compounds such as chlorinated benzenes, chlorinated phenols and PCB's, or

- from chemically unrelated chloro-organic compounds such as polyvinyl chloride (PVC).

iii) Synthesis by a complex array of thermal reactions from non-chlorinated precursors and inorganic forms of chlorine.

The first source is not considered to be a major contributor because only trace or non-detectable quantities have been analyzed in wastes that have emitted dioxins during combustion. The formation of dioxins from chlorinated organic precursors is confirmed by laboratory experiments. Little is known, though, on the quantitative importance of these reactions in real incineration processes. Trace quantities have also been detected from laboratory burning of material that does not contain synthetic organochlorine compounds.

Experimental information on the actual formation of dioxins during incineration includes studies of refuse incineration, waste oils in cement kilns and a variety of industrial waste incinerator types. In 1980 the ASME Research Committee on Industrial and Municipal Wastes initiated a study on dioxins from combustion sources. A comprehensive report was published in 1981 (Little, 1981). The report stated, "in both municipal and industrial waste combustion facilities, the specific, highly toxic 2,3,7,8-TCDD isomer does not appear to be a major component relative to the total quantity of tetra-CDDs, which are themselves trace components of the emissions."

The formation of dioxins by the thermal degradation of chlorinated precursors is thought to occur below rotary kiln combustion temperatures. Formation of the PCDD groups has been measured at combustion temperatures ranging from 200°C to 850°C. A series of tests has been interpreted as suggesting that 750°C may be optimum for net production of PCDDs from precursors. Lower temperatures presumably correspond to less PCDD formation, while higher temperatures result in destruction of the PCDDs that may be formed (Ahling et al, 1977).

M-2.2.3 FLUE GAS TREATMENT SYSTEMS

Various systems are available for the treatment of flue gases from waste incinerators. These systems are usually a combination of equipment to treat acid gases and equipment to treat particulate matter and metals.

Control of acid gases, i.e., hydrogen chloride (HCl), hydrogen fluoride (HF) and sulphur dioxide (SO_2), is by wet or dry scrubbing systems. These systems may also involve use of a venturi scrubber followed by one or more packed towers or tray towers, or tower scrubbers only. In some instances electrified scrubbers have been used. Venturi scrubbers operate at high pressure drops (about 7 kPa), but are also capable of controlling particles. Packed towers, tray towers or absorption towers are primarily intended for HCl, SO_2 and HF removal and have pressure drops of 1 to 2.5 kPa. Packed towers may provide some particulate matter removal, but low pressure systems such as these have low particulate matter removal efficiencies for small particles (diameters less than 5 μm). Alkaline scrubbing liquids are usually used. American experience suggests a 99% removal efficiency for HCl using either water or an alkaline scrubbing liquid (Trenholm et al, 1984).

European experience indicates removal efficiencies of 91 to 99.8% for HCl, 70 to 95% for SO_2 and 95 to 99% for HF (Fichtel, 1982; Orklid, 1982; Maurer, 1984; NUKEM, 1986).

Dry gas scrubbing is becoming an increasingly viable alternative to wet scrubbing. In addition to removal of acid gases, a significant reduction in heavy metals contained in the flue gases can be achieved. Atomized lime slurry produces particles which adsorb the bulk of the vapour-phase heavy metals such as mercury, cadmium, arsenic and lead (Kroll & Williamson, 1986).

Evaluations of wet scrubber HCl removal efficiencies at the Biebeshiem incinerator indicate no variations in performance with wastes of high or low chloride content. Removal efficiencies were approximately 99% and greater for both normal feed concentrations (approximately 5% chlorides) and high feed concentrations (10-15% chlorides).

Some "scrubber-only" systems, or systems with scrubbers downstream of particulate removal equipment, have experienced relatively high particulate emissions as a result of alkaline salt droplet carryover (Trenholm et al, 1984; Gorman and Ananth, 1982). Any solids dissolved into water droplets will become potential airborne emissions, but may be removed by downstream particulate removal equipment or mist eliminators prior to discharge to a stack.

Particulate removal can be accomplished by venturi scrubber, electrostatic precipitators (ESP's) or fabric filters. The operation and removal efficiencies of these three types of control equipment is well known. For particle diameters of 2 microns and greater, a high efficiency ESP is generally the least efficient (98.5%); a venturi scrubber can achieve 99.5%, while the fabric filter is generally the most efficient (99.9%). Operational data on electrostatic precipitators for cleaning flue-gases from waste incinerators show particulate matter removal efficiencies of 90.0 to 99.9% (Orklid, 1982; Fabian et al, 1979). The lower efficiency (90%) refers to an electrostatic precipitator that cleans flue-gases exiting a waste heat boiler. The higher efficiency (99.9%) is for a precipitator downstream of a spray dryer.

As previously mentioned, control equipment removal efficiencies for metals are variable. The removal efficiency depends not only on the type of control equipment but also on the specific metals in the waste, the waste type and the combustion/incineration system. Control

efficiency for metals is not necessarily the same as the control efficiency for particulate matter. Experience from waste incineration indicates that control efficiencies for metals are frequently lower. Control efficiencies for mercury, which is readily vapourized, have been measured in the range of 42 to 93% (Fichtel, 1982; Maurer, 1984; Oberg and Aittola, 1984). Other metals have reported control efficiencies which range from less that 50% to 99.9% (Trenholm et al, 1984; Maurer, 1984; Oberg and Aittola, 1984). However, the majority of those reported have control efficiencies in the range of 90 to 99.9%.

M-2.2.4 POLLUTANT EMISSIONS

M-2.2.4.1 Acid Gases

The generation of acidic gases and, in particular, hydrogen chloride (HCl), is a concern in the incineration of wastes. Polyvinyl chloride materials in solid wastes and various chlorinated hydrocarbons in liquid organic wastes result in emissions of HCl from the combustion of these fuels. Emissions of HCl are dependent on the waste type, the chlorine content in waste, the incinerator type and the gaseous and particulate treatment and control equipment. Table M-4 summarizes hydrogen chloride emissions from waste incineration. Concentrations of HCl in the controlled exhaust gases vary by an order of magnitude. This is primarily due to the variation in the chlorine content of the waste. Flue-gas treatment which utilizes acid gas scrubbing will also reduce HCl emissions, Table M-4.

Information on acidic hydrogen fluoride gaseous emissions is scarce. Reported emissions of hydrogen fluoride for the Kommunekemi incinerators indicate a large variation in emission rates, most likely due to variability of fluorides in the waste feed. Acid gas control information reports treated flue-gas concentrations of 0.1 to 1.0 mg/m^3 hydrogen fluoride (Orklid, 1982). Kristensen (1985) reports an average hydrogen fluoride concentration of 0.34 mg/m^3 and a short-term peak of

8.9 mg/m^3, for the Danish Kommunekemi incinerator, which is higher than the Danish guideline of 5 mg/m^3. Two German incinerators report hydrogen fluoride exhaust concentrations of 1 to 3 mg/m^3 (Fichtel, 1982). Studies at the Biebeshiem facility measured hydrogen fluoride exhaust concentrations of 0.25 and 0.9 mg/m^3 (NUKEM, 1986) and control efficiencies of 98.0 to 99.4%.

Sulphur dioxide from sulphur in the waste feed or sulphur in the auxiliary fuel has been measured in various European incinerators and the range of results is presented in Table M-4. The 800 mg/Nm^3 maximum presented in Table M-4 is a short-term peak value measured at the Bayer West German facility (Fabian et al, 1979).

Levels of nitrogen oxides, which arise from high temperature combustion of air, are also presented in Table M-4. The maximum value of 1000 mg/Nm^3 is also a short-term peak value measured at Bayer (Fabian et al, 1979).

M-2.2.4.2 Metals

The presence of metals in the organic waste results in metals emissions to the atmosphere. Many metals evaporate in the flame, either as such, or in the form of volatile oxides, chlorides or other salts. When arriving at the cooler parts of the incineration exhaust system, such as the heat recovery boiler or wet scrubbing systems, the vapourized metals condense to form aerosols of submicron particles. The number of comprehensive studies on the fate of various metals is fairly modest. Studies have concentrated on the analysis of heavy and toxic metals which are in the vapour state. Most of the heavy metals in the waste remain in the bottom ash. The portion which forms fine airborne particulate is removed by the flue-gas treatment equipment, with the probability of a small portion passing through the control system and being emitted to the atmosphere.

A mass balance of metals at the West German Biebeshiem waste incinerator confirmed that the majority of metals which enter with the feed remain in the kiln slag, the boiler ash and the dry scrubber salt (NUKEM, 1986). A group of iron, chromium, copper and nickel were emitted in quantities of less than 1 percent of the feed rate. These four metals end up in the rotary kiln slag. There were also five metals that were emitted at quantities greater than 1 percent of the feed rate; lead - 2%, cadmium - 3%, zinc - 1.8%, tin - 2% and mercury - 50%. These five metals end up in the dry scrubber salt. A mass balance for four metals was also conducted at the SAKAB Swedish waste incinerator (Oberg and Aittola, 1984). For a group of cadmium, arsenic and lead, approximately 99% of the metal in the feed was measured in the kiln slag and the bottom ash. However, stack emissions of mercury were 51% of the mercury in the waste feed.

Table M-5 lists fourteen metals and their concentrations in organic waste. These analyses are from a limited number of investigations and should not be considered comprehensive. Also included for comparison purposes in Table M-5 are concentrations of these 14 metals in Canadian coals and residual oil. Metals can exist in organic industrial wastes at concentrations greater than those found in coals and oil. However, there is some overlapping of metal concentrations between fuels at concentrations of a few hundred µg/g or less. A similar list of metals and their concentrations (mass per unit volume of flue gases) in controlled incinerator off-gases is presented in Table M-6. A similar ordering of metals to those in typical waste fuel is present in the emission data. A group of lead, zinc, nickel and chromium is predominant in both organic waste incinerator feeds and the resultant air emissions.

Some trace metals in industrial waste can be emitted in vapour form and may be difficult to control. As an indication of this problem, emission data from sewage sludge incinerators (Gerstle and Albrinck, 1982) show that practically all mercury in sewage sludge escapes scrubber

control. As well, 2 to 40% of the initial arsenic content is reported to pass through wet scrubbing equipment. Metallic constituents such as copper, chromium and zinc are reported to remain in the fly ash and may be retained quite efficiently by flue gas scrubbers. Under most circumstances, it can be expected that most trace metals would be emitted as oxides while, under certain conditions, emissions of metal chlorides, carbonates or sulphates also could occur (Fabian et al., 1979; Gerstle and Albrinck, 1982). Information on the emission of beryllium from waste incineration is scarce. Flue-gas beryllium concentrations for a coal-fired cement kiln which was co-fired with industrial waste were in the range of 0.007 to 0.04 mg/m^3 (Vollmer and Lutzke, 1982).

M-2.2.4.3 Organics

As previously mentioned, the evaluation of industrial waste incinerator performance is based on thermal destruction efficiency. The published literature on incinerator trial burns or research tests report on the ability to achieve 99.99% DRE for POHC's or 99.9999% DRE for PCB wastes. Information is scarce on actual organic compound concentrations in the stack exhaust. Organic compounds in the exhaust can be both products of incomplete combustion (PIC's) and unburned organics. Flue-gas concentrations for PIC's measured for 6 American incinerators are presented in Table M-3. Volatile organic compounds measured in the flue-gas during PCB trial burns for a rotary kiln are presented in Table M-7. Since the principal organics in the feed for these trial burns were PCB's and chlorobenzenes, the compounds in Table M-7 could also be considered PIC's.

In addition to specific organic compounds analzyed in exhaust gases, total hydrocarbons have been monitored (Trenholm et al., 1984; Kristensen, 1982). Total hydrocarbon concentrations in stack exhausts ranged from less than 1 mg/m^3 to 40 mg/m^3 (1 ppm to 60 ppm) with most values below 8 mg/m^3 (10 ppm).

Since the ASME report (Little, 1981) the data base on emissions of PCDD's and PCDF's from combustion sources has increased considerably. A summary of dioxin and furan emission measurement studies for industrial waste incineration is presented in Table M-8. The majority of the total dioxin measurements are less than 1 ng/m^3, except for the SAKAB and SCA chemical facilities (Oberg, 1984; CARB, 1983). The maximum detected concentration of the toxic 2,3,7,8-TCDD isomer is 1.5 ng/m^3 at the SAKAB facility (Rappe et al, 1984). At the HIM Biebeshiem incinerator there was no difference in dioxin and furan emissions between the firing of PCB wastes and non-PCB chlorinated wastes. In the other measurements, 2,3,7,8-TCDD was not detected (Brenner et al., 1983; CARB, 1983). Total furans were approximately 10 ng/m^3. A maximum emission rate of 5.1 mg/h total furans is based on data from the SCA chemical facility (CARB, 1983).

Information on separate dioxin and furan isomer levels from SAKAB (Aittola et al, 1985; Aittola and Oberg, 1984) and HIM (NUKEM, 1986) is available for application to the OWMC incinerator. These incinerators are both Von Roll rotary kiln systems. In addition, insufficient data was available for other rotary kiln industrial hazardous waste incinerators. Stack concentrations of dioxins and furans for these two facilities are presented in Table M-9. The upper ranges of the data from SAKAB are greater than those of HIM by two orders of magnitude. The high levels of SAKAB were measured during the facility decommissioning period and therefore are not representative of optimal normal operation. They may be considered typical of upset or non-optional conditions.

M-2.2.4.4 Primary Pollutants

Emission data for primary pollutants such as total suspended particulate and carbon monoxide have been obtained from European and United States sources. Stack emission concentrations (mass per unit volume of flue

gases) of several constituents have been documented for rotary kiln incinerators and are presented in Table M-10. The maximum particulate value of 183 mg/m^3 is for a rotary kiln flue-gas treatment system consisting of a gas scrubber followed by two particulate scrubbers in series which was not operating under normal conditions (GE, 1985).

M-3 EMISSION ESTIMATES FOR THE OWMC INCINERATOR

Each incineration train at the OWMC facility will include the following components:

- rotary kiln
- secondary combustion chamber
- waste heat recovery boiler
- flue gas treatment system
- flue-gas reheater
- stack

Also associated with the incinerators would be waste feed and ash handling systems. A discussion of potential emissions from these ancillary systems is presented in Appendix P dealing with fugitive emissions. It is presently anticipated that the incinerators will incinerate three types of organic waste: (i) liquid wastes and pumpable sludges, (ii) solid wastes and non-pumpable sludges, and (iii) low volatility solid wastes. Further process details, adopted for the purposes of this study, are summarized in Table M-11.

One and ultimately two 30 000 t/a capacity rotary kiln incinerators, with secondary combustion chambers, will thermally destroy the organic wastes. Gases will pass from a waste heat recovery boiler into a flue-gas treatment system. The system consists of a spray dryer, an electrostatic precipitator, an induced draft fan, a multi-stage wet scrubber and a stack.

Potential incinerator emission rates were determined from OWMC facility design information (Table M-11), emission data presented in Section 2.2 and from OWMC expected emission guarantees (see Table M-12).

The following criteria were used in estimating emission rates:

- except as noted in (ii) and (iii) below, emission rates were based on the supplier's quaranteed and expected exhaust concentrations with the maximum design exhaust flowrate and the average exhaust flowrate, respectively.

- in the absence of emission data from OWMC's supplier, the average and largest exhaust concentrations found in literature were used.

- emissions of unburned or residual organics were based on a DRE of 99.99% (99.9999% for PCB's) with either the average or maximum feed rate for each compound.

M-4 REFERENCES

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TABLE M-1

AIR POLLUTANTS FROM WASTE COMBUSTION

Chemicals in Waste	Resultant Air Pollutant
Chlorinated Hydrocarbons	Hydrogen Chloride, Dioxins
Bromine	Hydrogen Bromide
Fluorine	Hydrogen Fluoride
Sulphur	Sulphur Oxides
Phosphorus	Phosphorous Pentoxide
Carbon, Nitrogen	Cyanide Compounds
Iodide Compounds	Iodine
Metals	Particulate matter (metallic oxides, carbonates) Vapours

Note: Significant quantities of nitrogen and oxygen are also present in combustion air. These will react to produce compounds such as nitrogen oxides, carbon monoxide, carbon dioxide and water.

TABLE M-2

ORGANIC COMPOUNDS IN WASTE STREAMS*

Organic Compound	Number of Waste Streams in Which Compound Detected
Toluene	15
Tetrachloroethylene	9
Trichloroethylene	9
Carbon tetrachloride	7
Methyl ethyl ketone	6
Naphthalene	6
Phenol	6
Chloroform	5
Methylene chloride	5
Butyl benzyl phthalate	4
1,4-Dichloro-2-butene	4
Aniline	3
Benzyl chloride	3
Bis-(ethyl hexyl) phthalate	3
Chlorobenzene	3
1,1,1-Trichloroethane	3
Benzene	2
Diethylphthalate	2
Phthalic anhydride	2
15 other principal organic hazardous constituents (POHC's)	1 each

* Total number of waste streams = 19.

Source: Trenholm et al., 1984.

TABLE M-3

PRODUCTS OF INCOMPLETE COMBUSTION
IN STACK EXHAUST

Products of Incomplete Combustion	Number of Incinerators	Concentration in Stack Exhaust (ug/m^3)
Benzene	6	12-670
Chloroform	5	1-1,330
Bromodichloromethane	4	3-32
Dibromochloromethane	4	1-12
Naphthalene	3	5-100
Bromoform	3	0.2-24
Chlorobenzene	3	1-10
Tetrachloroethylene	3	0.1-2.5
1,1,1-Trichloroethane	3	0.1-1.5
Toluene	2	2-75
o-Nitrophenol	2	25-50
Methylene chloride	2	2-27
Phenol	2	4-22
2,4,6-Trichlorophenol	1	110
Carbon disulphide	1	32
o-Chlorophenol	1	2-22
2,4 Dimethyl phenol	1	1-21
Methylene bromide	1	18
Bromochloromethane	1	14
Trichlorobenzene	1	7
Hexachlorobenzene	1	7
Diethyl phthalate	1	7
Pentachlorophenol	1	6
Dichlorobenzene	1	2-4
Methyl chloride	1	3
Methyl ethyl ketone	1	3
Methyl bromide	1	1
Pyrene	1	1
Fluoranthene	1	1

Note: Products of incomplete combustion are compounds found in the stack exhaust, but not found in concentrations above 100 ug/g in the waste feed.

Source: Trenholm et al., 1984.

TABLE M-4

ACID GAS EMISSIONS FROM WASTE INCINERATION

Acid Gas	Incineration Type	Controlled Emissions (mg/m^3)
Hydrogen Chloride	Organic Wastes - Rotary Kilns[a,b,c,d,e,f]	
	• With Scrubbing	1-145
	• Without Scrubbing	190-526
	Organic Wastes - Liquid Injection, Rotary Kiln, Hearth, Gas Injection[g,h]	23-220
	Solid Refuse - Municipal[i,j]	57-420
Hydrogen Fluoride	Organic Wastes - Rotary Kilns[a,d,e,f]	0.1-8.9
Nitrogen Oxides	Organic Wastes - Rotary Kilns[b,c,e,f]	13-1000
Sulphur Dioxide	Organic Wastes - Rotary Kilns[a,b,c,d,e,f]	10-800

Sources:

a. Fichtel, 1982
b. Kristensen, 1982
c. Fabian et al., 1979
d. Orklid, 1982
e. NUKEM, 1986
f. Kristensen, 1985
g. Trenholm et al., 1984
h. Gorman & Ananth, 1982
i. Jahnke et al, 1977
j. USEPA, 1985

TABLE M-5

TRACE METALS IN WASTES AND FUELS (ug/g)

Metal	Organic Wastes[a,b,c,d]	Canadian Coals[e]	Residual Oils[f]
Lead	1 - 9830	2 - 10	3.5
Nickel	1 - 6670	4.5 - 341	42.2
Chromium	1 - 2170	3 - 45	1.3
Zinc	490 - 1770	4.5 - 138	1.26
Barium	1 - 1460	60 - 1190	1.26
Selenium	1 - 380	4	0.7
Cadmium	1 - 224	5 - 9	2.3
Vanadium	147	5 - 108	160
Antimony	20 - 90	0.5 - 5.0	0.4
Arsenic	1 - 64	0.8	0.8
Manganese	35 - 47	10 - 172	1.33
Mercury	1 - 4	0.02- 1.2	0.04
Beryllium	1 - 5	0.9	0.08
Silver	0.5	0.3	0.3

Note: Trace metals in Canadian coals and residual oils are included in the table for comparative purposes.

Sources:
a. Gorman and Ananth, 1982
b. Trenholm et al., 1984
c. Vollmer and Lutzke, 1982
d. Higgins and Helmstetter, 1982
e. Landheer et al, 1982
f. Surprenant et al. 1981

TABLE M-6

METAL EMISSIONS FROM INDUSTRIAL WASTE INCINERATION

Metal	Emission Concentration (ug/m^3)
Lead	15.3 - 3000
Zinc	4.3 - 7000
Copper	130 - 500
Iron	1000
Nickel	1.6 - 60
Chromium	1.6 - 140
Mercury	0.1 - 100
Arsenic	1 - 5.9
Selenium	1 - 2
Cadmium	.05 - 60

Sources:
a. Gorman and Ananth, 1982
b. NUKEM, 1986

TABLE M-7

ORGANIC COMPOUND FLUE GAS CONCENTRATIONS

Compound	Range ($\mu g/m^3$)
1,1 Dichloroethane	1.2-2.2
1,1 Dichloroethylene	1-1.5
1,1,1 Trichloroethane	10-18
1,2-Dichloroethylene	18-41
Benzene	11-23
Bromodichloromethane	4.7-10
Bromoform	<1-2.2
Carbon Tetrachloride	12-27
Chlorobenzene	8.8-13
Chloroethane	<1-2.3
Chloroform	53-150
Dibromochloromethane	<1-6
Methyl Chloride	11-280
Methylene Chloride	5.4-7.1
Tetrachloroethane	1.5-2.8
Toluene	9.1-80
Trichloroethane	1-1.1
Vinyl Chloride	<1-14
Xylene	<1-2.2

Source: GE, 1985

TABLE M-8

SUMMARY OF DIOXIN AND FURAN EMISSION MEASUREMENTS FROM INDUSTRIAL WASTE INCINERATORS

Facility	Dioxins	Furans	Comments
BASF AG[a] (rotary kiln)	No detection of 2,3,7,8-TCDD, other TCDD's, PCDD's, HCDD's, and OCDD's. Detection limit of 1 ng/m^3	No measurements reported	Incineration of wastes containing 9% chlorine at 1000°C , gas residence time of 3 to 7 seconds.
SAKAB[b] (rotary kiln)	Max. 2,3,7,8-TCDD measured = 1.5 ng/m^3. Max. TCDD's measured = 216 ng/m^3	Max. 2,3,7,8-TCDF measured = 22 ng/m^3. Max. TCDF's measured = 3060 ng/m^3	
HIM[c] (rotary kiln)	Max. 2,3,7,8-TCDD measured = 0.03 ng/m^3 (0.0016 mg/h), Total TCDD's measured = 0.57 ng/m^3 (0.03 mg/h), Max. measured = 1.5 - 8.1 ng/m^3 (OCDD's) (0.08 - 0.43 mg/h)	Max. 2,3,7,8-TCDF measured = 0.37 ng/m^3 (0.02 mg/h). Total TCDF's measured = 16.2 ng/m^3 (0.86 mg/h), Max. measured = 9.5 - 11.6 ng/m^3 (HCDF's) (0.5 - 0.6 mg/h)	Emissions did not vary with PCB feed rate (1.2 vs 0.15 t/h). Emissions did not vary with combustion temperature (1000°C vs 1200°C). Exhaust flowrate 53 000 Normal m^3/h

TABLE M-8 (cont'd)

SUMMARY OF DIOXIN AND FURAN EMISSION MEASUREMENTS FROM INDUSTRIAL WASTE INCINERATORS

Facility	Dioxins	Furans	Comments
SCA Chemical[d] (rotary kiln)	Total PCDD's measured = 1.1 mg/h. (max.) No 2,3,7,8-TCDD detected	Total PCDF's measured = 5.1 mg/h(max.)	Feed rates during testing: 3.35 t/h liquids 1.32 t/h solids
Rollins[d] (rotary kiln)	Total PCDD's measured = 0.037 mg/h (0.64 ng/m^3)	Total PCDF's measured = 0.576 mg/h (9.9 ng/m^3)	Feed rates during tests: 1.14 t/h solids
Ensco[d] (rotary kiln)	Total PCDD's measured = 0.006 mg/h (0.18 ng/m^3)	Total PCDF's measured = 0.076/mg/h (2.68 ng/m^3)	Feed rates during tests = 0.33 t/h

Source: a) Brenner et al, 1983
b) Aittola et al, 1985; Aittola & Oberg, 1984
c) Gorgenyi and Maurer, 1985
d) CARB, 1983

TABLE M-9

DIOXINS AND FURAN ISOMERS (ng/m^3)

Isomer	SAKAB[a)]	HIM[b)]
Dioxins		
Total Tetra-CDD's	0.48-216	0.30-0.51
2,3,7,8-TCDD	0.024-1.5	0.02-0.03
Total Penta-CDD's	0.36-79	0.5-0.8
1,2,3,7,8-PCDD's	0.1-4.4	0.03-0.08
Total Hexa-CDD's	1.7-26	0.8-1.5
Total Hepta-CDD's	-	1.1-1.7
Total Octa-CDD's	0.07-5.8	1.5-4.9
Furans		
Total Tetra-CDF's	9.9-3060	1.5-4.7
2,3,7,8-TCDF	1.6-22	0.09-0.37
Total Penta-CDF's	31-350	1.7-8.9
1,2,3,7,8-PCDF	1.5-35	0.10-0.84
2,3,4,7,8-PCDF	1.8-18	-
Total Hexa-CDF's	11-128	9.5-13.1
Total Hepta-CDF's	1.1-43	5.9-9.7
Total Octa CDF's	0.2-5.8	1.4-5.9

a) Aittola et al, 1985; Aitolla and Oberg, 1984
b) NUKEM, 1986

TABLE M-10

EMISSIONS OF PRIMARY POLLUTANTS FROM INDUSTRIAL WASTE INCINERATION

Contaminant	Emission Concentration (mg/m^3)
Total Suspended Particulates[a,b,c,d,e]	2.4-183
Carbon Monoxide[b,d,e]	6-330

Sources:
a) Orklid, 1982
b) Kristensen, 1982
c) Fabian et al, 1979
d) Kristensen, 1985
e) NUKEM, 1986

TABLE M-11

INCINERATOR SYSTEM - SUMMARY OF ASSUMED PROCESS DETAILS

Subcomponent	Waste	Design
Rotary Kiln	Organic wastes (liquids, sludges, drums and solids)	1 or 2 kilns Combustion temperature of 1000 - 1400°C
Ash Handling	Boiler ash	6 t/d
	Salt + Fly ash	48 t/d
Stack	Flue gases	One stack, two flues Equivalent exit diameter = 1840 mm Exit velocity = 20 m/s Exit temperature = 130°C Height = 60 m Maximum flue gas flowrate = 50 800 Normal $m/^3h$ Average flue gas flowrate = 22 860 Normal m^3/hr (at 50% excess air dry, 7% O_2)

Source: Monenco, 1985

TABLE M-12

INCINERATOR SYSTEM - FLUE GAS
CONCENTRATIONS FROM OWMC SUPPLIER

Contaminant	Flue Gas Concentration (mg/Normal m^3) Expected	Guaranteed*[1]
Acid Gases		
Hydrogen chloride	15	70
Hydrogen fluoride	1	4
Sulphur dioxide	15	350
Metals*[2]		
Antimony	5	14
Arsenic	1	2.8
Cadmium	0.2	0.6
Chromium	1	2.8
Cobalt	1	2.8
Copper	5	14
Lead	5	14
Manganese	5	14
Mercury	0.2	0.6
Nickel	1	2.8
Selenium	1	2.8
Tellurium	1	2.8
Thallium	0.2	0.6
Vanadium	5	14
Other		
Carbon monoxide	70	280
Cyanide	5	14
Particulate	15	70
Total hydrocarbons	15	56

TABLE M-12 (cont'd)

INCINERATOR SYSTEM - FLUE GAS
CONCENTRATIONS FROM OWMC SUPPLIER

*Note:

1. OWMC emission guarantees are based on current West German regulations, which require that:

- the average daily flue gas concentration must not exceed the specified maximum
- 3 percent of the time the half-hour average concentration may exceed the specified daily maximum by a factor of 1.2
- all half-hour average concentrations must not exceed twice the average specified daily maximum. The maximum concentrations given above are half-hour averages and, thus, are twice the maximum values quoted in the emission guarantees.

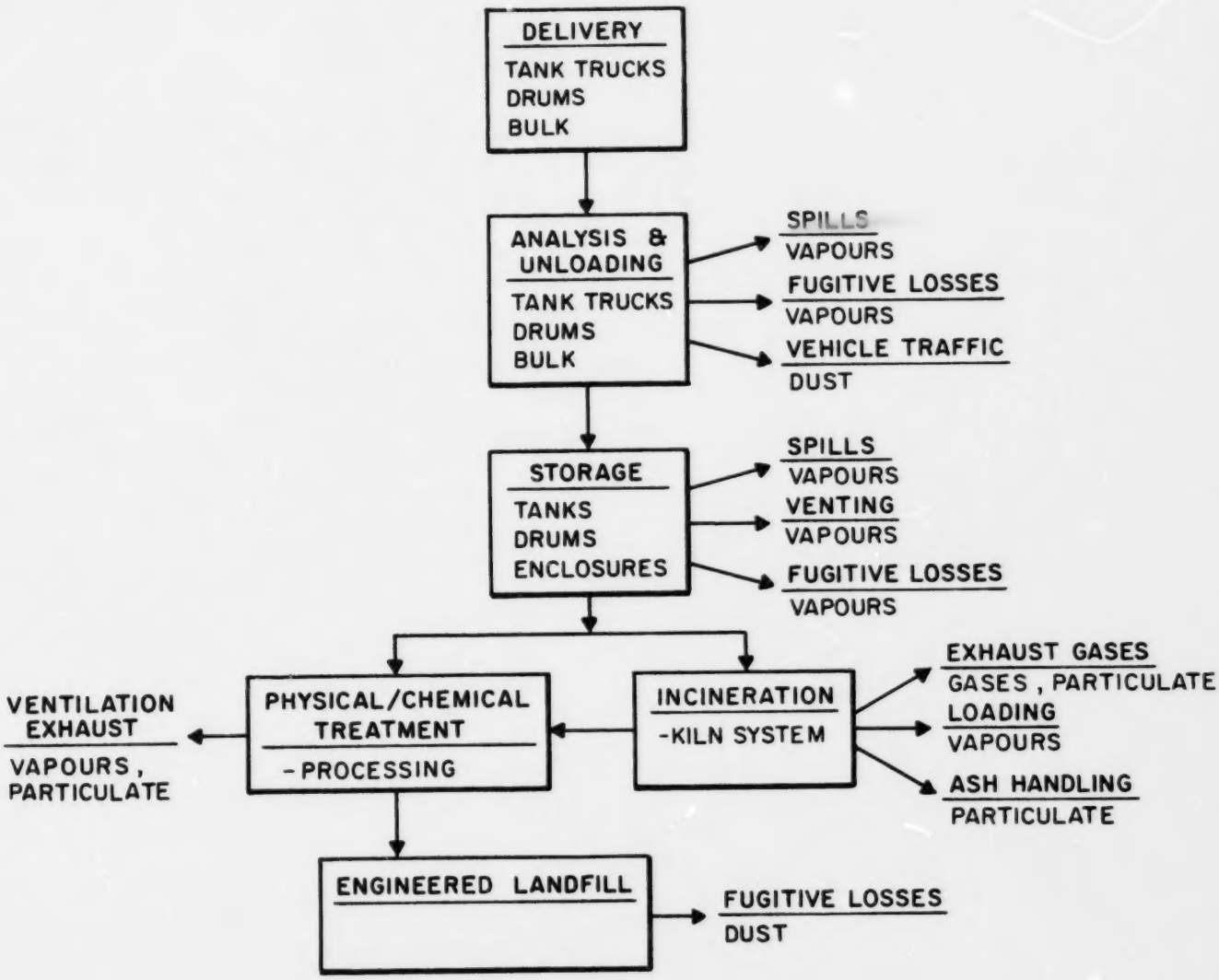
2. In addition to the specific metal values presented, the following conditions also apply:

- the expected concentration for the sum of antimony, copper, lead, manganese and vanadium is 5 mg/Normal m^3
- the guaranteed maximum concentration for the sum of antimony, copper, lead, manganese and vanadium is 14 mg/Normal m^3
- the expected concentration for the sum of arsenic, chromium, cobalt, nickel, selenium and tellurium is 1.0 mg/Normal m^3
- the guaranteed maximum concentration for the sum of arsenic, chromium, cobalt, nickel, selenium and tellurium is 2.8 mg/Normal m^3
- the expected concentrations for the sum of cadmium, mercury and thallium is 0.2 mg/Normal m^3
- the guaranteed maximum concentration for the sum of cadmium, mercury and thallium is 0.6 mg/Normal m^3

Source: Environmental Elements, 1985

Figure M-1

HAZARDOUS WASTE TREATMENT FACILITY
POTENTIAL SOURCES OF AIR EMISSIONS



APPENDIX N

DERIVATION OF EVAPORATOR EMISSIONS

N-1 INTRODUCTION

The purpose of this appendix is to describe the methodology used in quantifying emissions to the atmosphere from the evaporator associated with the physical/chemical treatment plant.

N-2 METHODOLOGY

Emissions from the evaporator venting depend on the contaminant species in the waste feed to the Physical/Chemical Treatment Plant. Due to the uncertainty in the waste characteristics, estimates were made using two approaches (Monenco, 1987). The first approach is listed below:

- Identify the contaminants of concern in each family of chemicals based on toxicology and treatability.

- Estimate the quantity of the waste stream which contains the specific contaminants. The estimate is based on the OWMC waste characterization data and supplemented by the generic waste information.

- Estimate the expected contaminant concentration after the physical/chemical treatment.

- Calculate the maximum contaminant discharge rate from the evaporator based on scenarios of venting large quantity of steam for a short duration.

The second approach differs from the first approach in the method used in identifying the contaminants and estimating the quantity of wastes which contain the contaminant. However, both approaches were based upon the OWMC waste characterization data which has been collected. In the second approach it is assumed, on a short-term basis, that all inorganic waste entering the physical/chemical treatment plant, at a rate of 15 t/h, could contain the specific contaminant. On very rare occasions, the treated effluent containing the specific residual contaminant could be accummulated and subsequently disposed of by the evaporator at full venting mode. If the treated effluent originated from condensation or reverse osmosis was used for incinerator scrubber make-up, the residual contaminants in the water can be effectively disposed of at the incinerator stack. To cover these two factors, the organic contaminant emission estimate was increased by a factor of 2.4 (an equivalent waste flow rate of 36 t/h).

N-3 REFERENCE

Monenco, 1987, "Facility Characteristics Report - Phase 4B", in preparation for Ontario Waste Management Corporation.

APPENDIX O

FUGITIVE EMISSIONS DURING FACILITY OPERATIONS

O-1 INTRODUCTION

The purpose of this appendix is to identify and quantify, on a preliminary basis, potential fugitive emissions to the atmosphere from the integrated industrial waste management facility proposed by OWMC. These estimates are limited to consideration of expected routine emissions and do not consider emissions which may result from process upsets. Data from this appendix will assist in evaluating the impacts of air emissions from the proposed facility.

Data from similar industrial waste treatment plants, emission factors for similar liquid organic compound handling, and emission factors for similar dust handling or processing operations are referenced in estimating fugitive emissions from the OWMC facility.

O-2 EMISSION CHARACTERIZATION

Emissions of hydrocarbons from the components of a waste management facility other than the incinerator exhaust stack have been reported in the literature. These hydrocarbon emissions originate from the handling and treatment of wastes containing volatile organic chemicals. The organic wastes are generally received in tank trucks or drums, are unloaded into the receiving tanks and then transferred to an incinerator tank farm. At the incinerator tank farm the wastes are blended and stored prior to incineration. Fugitive hydrocarbon emission can be released from the storage tanks, and from leaking pipe fittings, flanges, pumps and valves.

Emission factors for hydrocarbon emissions from storage and fugitive losses have been derived from experience in the petroleum and refinery industry (USEPA, 1985; USEPA, 1981; USEPA, 1980). These factors have been adapted by others for hazardous waste incinerators and compared to measured fugitive emissions at a waste incinerator facility which was operating at a waste feed rate of approximately 9 t/h (Holton et al, 1981). Predicted emissions based on these emission factors were 20 times higher than the measured fugitive emissions. However, for both the predicted and measured cases, fugitive hydrocarbon emissions were largest from the storage area. Emissions from the distribution system were next, followed by the unloading and receiving area. Pumps, in-line valves and sampling connections were the main equipment components which gave rise to fugitive emissions. The measured emission rates for two compounds, chloroform and hexachloroethane, are presented in Table O-1. These two organic contaminants represent high- volatile (chloroform) and low-volatile (hexachloroethane) compounds. Emissions of chloroform were four orders of magnitude greater than the emissions of hexachloroethane.

Releases of volatile organic wastes have been measured at hazardous waste landfill sites (Karima, 1983; Walker, 1984 and Murphy et al, 1982). These landfill sites contained raw organic wastes in the form of liquid and sludges. These wastes had not undergone treatment or solidification prior to disposal in the landfill sites. In the proposed OWMC facility, only trace quantities of volatile organics are expected to remain in the physical/chemical treatment and incineration residues. These residues will be stabilized prior to landfilling. Because only trace quantities would thus be present in the stabilized residues, hydrocarbon emissions from OWMC's landfill are considered negligible.

Particulate emissions at the engineered landfill would be associated with the ash handling and soil moving operations. The vehicle traffic on-site also would result in re-entrained road dust emissions. The physical and chemical treatment processes used to stabilize and neutralize the wastes are performed in an aqueous environment, which reduces particulate emissions from this component of the facility to negligible levels. However, some particulate emissions are expected to be associated with the residue solidification process.

Published emission factor information is available for similar operations to calculate potential particulate emission rates. Particulate emissions for the operations of solidification, landfill topsoil handling, incinerator ash handling and vehicle traffic are derived in the following section, based on such published emission factors.

O-3 EMISSION ESTIMATES

Emissions of hydrocarbons and particulate matter from components of the waste management facility other than the incinerator stack are presented in this section, based on design information (Monenco, 1985).

The liquid wastes and pumpable sludges will arrive at the facility in tank or tank trailer trucks. Wastes will be transferred from trucks to a tank farm directly or via the below-grade unloading tank and in turn from the tank farm to the incinerator. The vents on the storage tanks will be directed to the incinerator where the vapours will be thermally destroyed. When the incinerator is not in operation the vents will be routed to a vapour recovery system, such as a carbon adsorber, to capture the organic vapours.

It is anticipated that non-pumpable sludges containing liquid or volatile organic chemicals will be delivered in drums, stored in the drum processing area and then fed directly, with the drum, into the incinerator. Drums may be unloaded and held without opening or emptying. Storing the drums sealed prevents the loss of vapours. Drums will be put into the rotary kiln after being punctured or opened just before they enter the kiln. An incinerator feed system will be designed for proper feeding of the drums.

Low-volatile solid waste, such as contaminated soil, if delivered to the facility in bulk by lugger truck or dump truck, will be stored in enclosed bunkers at the incinerator feed building. Because of the low-volatility, few vapours should be emitted. These solid wastes will be stored in the incinerator feed building, where it is protected from wind erosion. This low-volatile solid waste will be fed via an overhead crane grab to the incinerator feed chute.

Rotary kiln slag will be discharged into a water quench tank. A submerged scraper conveyor will remove the slag and transfer it to a container. Boiler ash from the waste heat recovery boiler and dry ash/salt from the flue gas treatment system will be removed continuously and conveyed to the solidification system. Dust control systems will be installed at the slag quench and handling area and the ash handling system.

Two approaches were taken in estimating fugitive hydrocarbon emissions from the OWMC facility. An estimation was first undertaken when only preliminary facility engineering process data were available. This involved calculating emissions from the storage of liquid organic wastes at the truck load-out area and the incinerator tank farm. Emissions from the liquid organic distribution system were then assumed to be equal to those calculated for the storage at the truck load-out

area. This assumption was based on the measured data presented in Table O-1, which indicates that the incinerator tank farm has the highest emission, followed by approximately equal emissions from the truck load-out and the distribution systems.

The emissions of volatile organic liquids from the storage facilities, based on preliminary engineering data, have been based on a fixed roof design with nitrogen blanketing and off-gas vent control. During normal operations the vent gases will be discharged into the rotary kiln incinerators. When the incinerators are not available for vent gas control, the off-gases will be controlled by an activated carbon adsorber. Losses from fixed roof tanks occur during storage (breathing losses) and during liquid loading operations (working losses). In order to estimate hydrocarbon emissions from volatile liquid waste storage, the compound 1,1,1-trichloroethane was assumed as a representative contaminant. Potential emissions from liquid organic storage (hydrocarbon emissions) are presented in Table O-2.

The following two equations were used to determine emissions from fixed roof tanks (USEPA, 1981):

$$Q_b = 2.26 \times 10^2 M \frac{P}{14.7-P}^{0.68} D^{1.73} H^{0.51} T^{0.5} F_p C k_c (1-I_a)(1-Eff)$$

Where Q_b = annual hydrocarbon breathing loss emission per tank

M = molecular weight of vapour (1,1,1,-trichloroethane) in storage tank (= 133 lb/lb mole)

P = true vapour pressure at bulk liquid conditions (= 1.93 psia)

D = tank diameter (ft)

H = average vapour space height, including roof volume correction (ft)

T = average ambient diurnal temperature change ($18^{o}F$)

F_p = paint factor (1.0)

C = adjustment factor for small diameter tanks

k = product factor (= 1.0)

I_a = incinerator availability for control (= 0.8)

Eff = factor for 95% control efficiency (= 0.95)

and $Q_w = 2.4 \times 10^{-2}$ MP Kn Kc (1-Ia) (1-Eff)

where Q_w = annual hydrocarbon working loss emission per tank ($lb/10^3$ US gal throughput)

M = molecular weight of vapour in tank (= 133.4 lb/lb mole)

P = true vapour pressure at bulk liquid conditions (= 1.93 psia)

K_n = turnover factor (for tankfarm = 1.0, for truck loadout = 0.5)

k_c = product factor (1.0)

I_a = incinerator availability for control (= 0.8)

Eff = factor for 95% control efficiency (= 0.95)

Estimated emissions for the truck loadout and tank from fixed roof tanks are summarized in Table O-3.

A second estimation of fugitive organic emissions was undertaken using detailed engineering process data on quantities and types of waste, numbers and types of storage vessels, and inventories of valves, fittings, etc. Fugitive emissions from routine leaks and spills were estimated using this detailed information in conjunction with emission factors from petroleum refining and the petrochemical industries. Fugitive emissions from the distribution and processing of the wastes were estimated using a simplified model and the design and operating philosophy of the facility. Both short-term and average emission quantities were determined. Details of this second fugitive organic emission estimation are presented in the risk assessment report prepared by Environ Corporation (1987).

This second more detailed estimation of emissions determined emission values greater than the preliminary estimate by two orders of magnitude. The more detailed estimates were similar to the measured emissions presented in Table O-1. Because the second emission estimation was more detailed and values were similar to those of an actual facility, the more detailed emissions were chosen as the preferred values and are used in Chapter 5 of the main report.

An emission factor for a process similar to the solidification treatment process was used to determine particulate releases to the atmosphere. The process selected was concrete batching which has an uncontrolled particulate emission factor of 0.12 kg/m^3 of product (USEPA, 1985). A 98 percent control efficiency was applied to this emission.

The emission of particulate was calculated as follows:

$$Q_s = 0.12\ kg/m^3 \times (1-0.98) \times 980\ t/d \times 1/(2.0\ t/m^3) \times 1/(8\ h/d) \times 1/3600 \times 1000\ g/kg = 0.042\ g/s$$

Where	Q_s	= emission of particulate from solidification
	$0.12\ kg/m^3$	= emission factor
	0.98	= factor for control efficiency of 98%
	980 t/d	= solidified waste production rate
	$2.0\ t/m^3$	= density of solidified waste
	8 h/d	= number of hours of operation per day
	1/3600	= hours per second
	1000 g/kg	= grams per kilogram

Most of these emissions will be cement dust and inert material. This emission value includes reagent (cement) handling and storage, and reagent and waste residue mixing and processing.

An uncontrolled particulate emission factor from handling of ash from coal fired thermal power plants, 0.1 kg/t of ash handled, was used (Miller et al, 1983). A control efficiency of 98% was also used.

The emission of particulate from boiler ash and flue gas control salts and ash handling was determined as follows:

$$Q_a = 0.1\ kg/t \times (1-0.98) \times 54\ t/d \times 1/(24\ h/d) \times 1/3600 \times 1000\ g/kg = 0.001\ g/s$$

Where:

Q_a	= emission of particulate from ash handling
0.1 kg/t	= emission factor
0.98	= factor for 98% control efficiency
54t/d	= ash handling rate
24h/d	= hours per day of operation
1/3600	= hours per second
1000 g/kg	= grams per kilogram

Vehicle fugitive road dust emissions from unpaved roads were calculated using the following emission factor equation.

Unpaved Roads

$$E = k\ (1.7)\left(\frac{s}{12}\right)\left(\frac{S}{48}\right)\left(\frac{W}{2.7}\right)^{0.7}\left(\frac{w}{4}\right)^{0.5}\left(\frac{365-p}{365}\right)$$

E = emission factor (kg/vehicle km travelled)
k = particle size multiplier (= .8 for TSP)
s = silt content of road surface material (%)
S = mean vehicle speed (km/hr)
W = mean vehicle weight (Mg)
w = mean number of wheels
p = number of days with at least 0.254 mm of precipitation per year

Equations used for calculating emission factors for handling soil, wind erosion from open areas, bulldozing, scraping and grading are listed below (USEPA, 1985).

Batch Drop Handling

$$E = k\ (.0009)\frac{\left(\frac{s}{5}\right)\left(\frac{U}{2.2}\right)\left(\frac{H}{1.5}\right)}{\left(\frac{M}{2}\right)^{2}\left(\frac{y}{4.6}\right)^{0.33}}$$

E = emission factor (kg/Mg of material handled)
k = particle size multiplier (for ≤30 μm, k = .73)
s = material silt content (%)
U = mean wind speed (m/s)
H = drop height (m)
M = material moisture content (%)
y = dumping device capacity (m^3)

Soil Erosion/Wind Erosion

$$E = 1.9 \left(\frac{s}{1.5}\right)\left(\frac{365 - p}{235}\right)\left(\frac{f}{15}\right)$$

E = emission factor (kg/day/hectare)
s = silt content (%)
p = no. of days in a year with greater than .254 mm precipitation
f = percent of time that wind speed exceeds 5.4 m/s

Bulldozing

$$E = \frac{2.6\ (s)^{1.2}}{(M)^{1.3}}$$

E = emission factor (kg/hr)
s = % silt
M = % moisture

Scraping

$$E = 9.6 \times 10^{-6}\ (s)^{1.3}\ (W)^{2.4}$$

E = emission factor (kg/vehicle km travelled)
s = silt content (%)
W = vehicle weight (Mg)

Grading

$$E = .0034\ (S)^{2.5}$$

E = emission factor (kg/vehicle km travelled)
S = speed travelled (kph)

Paved Roads

$$E = 10$$

E = emission rate (g/vehicle km travelled)

The parameters and assumptions used in the estimation of fugitive emissions during landfill operations are listed below. These assumptions may change, as new engineering data becomes available.

1. All dump trucks used in operations assumed to be 14 m^3 capacity (Dillon, 1987)

2. Landfill areas exposed to wind erosion were assumed to be landfill operations and excavation - 2.75 and 3.5 ha, for all years (Monenco, 1987). Any stockpiling assumed to be within the total 6.25 ha area, and therefore is not expected to increase the areas exposed to wind erosion.

3. Stockpile height of 5 m assumed (Monenco, 1987). A 3 month stockpile of excavated material from landfill assumed to be stored somewhere within the 250 x 250 m area during winter months.

4. Excavation of landfill to take place for only 6 months of year (Monenco, 1987).

5. Operation of landfill to take place all year round (Monenco, 1986).

6. Truck export of excavated clay materials from the landfill to take place all year round (Dillon, 1986).

7. Cover placement of completed segments of the landfill will be limited to the summer months (May to October), (Monenco, 1986).

8. Quantities of exported clay from landfill and granular deliveries to landfill are as follows (Mg/year):

	Yr. 1	Yr. 5	Yr. 10	
Granular deliveries	2300	7100	13900*	(Monenco, 1986)
Clay exports	176778	176778	271056*	(Dillon, 1987)

* for 300 K facility

9. Silt content of clay and gravel assumed to be 20% (Spangler and Handy, 1973, and USEPA, 1985).

10. Soil moistures of clay = 20%; gravel = 1% (Spangler and Handy, 1973, USEPA 1985, Monenco, 1986).

11. Sources of fugitive emissions were defined as listed below:

Facility	Area	Release Height
Landfill Area	250 x 250 m	1 m
Landfill-Excavation only	250 x 140 m	1 m
Landfill-Operation only	250 x 110 m	1 m
Phys/Chem Area	220 x 70 m	12 m*
Organic Storage Area	230 x 100 m	4 m*
Incinerator Area	95 x 45 m	7.5 m*
Storm Drainage Ponds	300 x 100 x 5 m	1 m
Surface Water/Firewater Ponds	272 x 60 x 5 m	1 m

* half the building/enclosure height (Monenco, 1986)

12. Excavation = 12 hr shifts; operations = 8 hr shifts (Monenco, 1986).

13. Dozers, scrapers, graders, backhoes, loaders moving/working 80% of time; compactors 40% of time (OWMC, 1987).

14. No berm construction was assumed during landfill activities (ORF assumptions based on OWMC uncertainties; OWMC, 1987).

15. Scrapers used to excavate topsoil (.5 m depth) only (ORF assumption).

16. 250 working days/year (Monenco, 1986).

17. 90% control on scraping, dozing and grading, wind erosion, and road dust from traffic (USEPA, 1985).

18. Dumping device capacities (for handling) used were gravel 14 m^3 (bottom dumping from truck); clay 2 m^3 (loader) (USEPA, 1985, Caterpillar, 1986, Dillon, 1987).

19. Unloading waste at the landfill not considered to be a source of dust, as the material should be solidified or partially solidified.

20. 2 scrapers assumed to be operating 80% of the time (12 hr day) at the landfill excavation site in year 1 (1 scraper in years 5 and 10).

21. 2 bulldozers assumed to be working on the excavation and 1 dozer at the landfilling operations 80% of the time (12 hr each @ excavation; 8 hr @ filling).

22. Dump trucks carrying out excavated materials to travel .5 km on-site (return trip) on unpaved roads.

23. Scraper weight of 34.7 t was used (Caterpillar, 1986).

24. The following characteristics were used for vehicles operating within the landfill area (Monenco, 1986; Caterpillar, 1986):

Vehicle Type	Mean Speed (kph)	Weight (Mg)	No. of Wheels
Dozer	10	27.8	4
Backhoe	3	63	4
Med. Compactor	8	15.1	4
14 m^3 Dump Trucks	12	31.	10
Fuel Maint. Truck	12	8.8	6
Pickup Truck	15	1.8	4
Lg. Compactor	8	31.3	4
Tracked Loader	8	18.	4
Dozer	6	8.7	4

25. Assumed that 1 m^3 of clay weighs 2000 kg; 1 m^3 of gravel weighs 2500 kg (USEPA, 1985).

26. For handling a drop height of 1 m was used.

27. Derived emission rates of fugitive dust based on the above are given in Table O-4.

28. Emission rates for TSP, CO, HC and NO_x attributable to vehicle traffic are provided in Table O-5.

29. For vehicle exhaust and paved road dust calculations, off-site vehicle speeds of 80 km/hr were assumed (along Hwy. 20).

30. Two vehicle emission scenarios were modelled. An average hourly case (neutral stability, light winds) was considered where the daily number of vehicles in 1995 (with or without the facility) was divided by 24. The worst-case scenario (extremely stable relatively calm winds) was modelled such that the peak hourly traffic flow was divided by 12 for the predicted traffic without the facility, 100 cars/hr (with the facility) assumed, and the daily number of trucks attributable to plant operation was divided by 8.

O-4 REFERENCES

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TABLE 0-1

SUMMARY OF MEASURED HYDROCARBON EMISSIONS
FROM AN ORGANIC WASTE STORAGE AND HANDLING FACILITY

Emission Area		Hydrocarbon Compound High-Volatile (chloroform)	Hydrocarbon Compound Low-Volatile (hexachloroethane)
Receiving & Loading	kg/h	0.0033	9.0×10^{-7}
	kg/t	0.0003	1×10^{-7}
Storage	kg/h	0.0083	25.6×10^{-7}
	kg/t	0.0004	2.8×10^{-7}
Distribution System	kg/h	0.0036	10.8×10^{-7}
	kg/t	0.0004	1.2×10^{-7}
Total	kg/h	0.0149	45.4×10^{-7}
	kg/t	0.0017	5.0×10^{-7}

Note: The waste feed rate to the incinerator was approximately 9 t/h during the measurement period.

Source: Holton et al, 1981

TABLE 0-2

POTENTIAL EMISSIONS FROM LIQUID ORGANIC STORAGE AND DISTRIBUTION, SOLIDIFICATION AND INCINERATOR ASH HANDLING

Process	Emissions (g/s x 10^{-3}) Hydrocarbons	Particulate Matter
Liquid Organic Storage		
- Truck loadout area	3.2	-
- Incinerator tank farm	23	-
Liquid Organic Distribution	3.2	-
Solidification	-	42
Incinerator Ash Handling	-	1.0

Note: a) "-" indicates that there are no significant emissions of hydrocarbons or particulate matter

TABLE O-3

LIQUID ORGANIC WASTE STORAGE EMISSIONS

(a) Breathing Losses

Process Area	Tank Capacity(m^3)	# of Tanks	Tank Diameter(m)	H (m)	C	Breathing Losses (g/s)
Truck Loadout	60	2	3.99	2.47	0.68	0.00025
Tank farm	120	50	5.00	3.26	0.8	0.0083
	60	8	3.99	2.47	0.68	0.00097
	40	8	2.99	2.83	0.5	0.00033
	10	8	2.01	1.58	0.35	0.00008

(b) Working Losses

Process Area	Throughput (U.S.gal/a)	K_n	Working Losses (g/s)
Truck Loadout	7.36×10^6	0.45	0.004
Tank farm	14.7×10^6	1.0	0.0131

Note: Formulae and symbols are explained in the text.

TABLE 0-4

Short-Term, Annual and Summer Landfill Dust Emission Factors (g/s)
(90% Control)

	Short-Term						Summer						Annual					
	Yr. 1		Yr. 5		Yr. 10		Yr. 1		Yr. 5		Yr. 10		Yr. 1		Yr. 5		Yr. 10	
	Exc.*	Op.**	Exc.	Op.	Exc.	Op	Exc.	Op	Exc.	Op.	Exc.	Op	Exc	Op	Exc	Op	Exc.	Op
Roads																		
Exc. Area	3.46	-	3.46	-	3.46	-	.91	-	.43	-	.43	-	.46	-	.22	-	.22	-
Op. Area	-	3.29	-	3.29	-	3.29	-	.39	-	.39	-	.39	-	.39	-	.39	-	.39
Gravel Del.	-	.25	-	.25	-	.25	-	.0005	-	.0016	-	.003	-	.0005	-	.0016	-	.003
Clay Exc.	.74	-	.74	-	.74	-	.05	-	.05	-	.05	-	.05	-	.05	-	.05	-
Handling																		
Unload Gran.	-	.002	-	.007	-	.013	-	.0006	-	.0019	-	.004	-	.0008	-	.0024	-	.0048
Load Exc. Clay	.0008	-	.0008	-	.0008	-	.0002	-	.0002	-	.0002	-	.0003	-	.0003	-	.0003	-
Dozing	.11	.05	.11	.05	.11	.05	.029	.010	.029	.010	.029	.010	.015	.010	.015	.010	.015	.010
Scraping	.684	-	.358	-	.358	-	.189	-	.1	-	.1	-	.094	-	.05	-	.05	-
Grading	.05	-	.05	-	.05	-	.014	-	.014	-	.014	-	.007	-	.007	0	.007	-
Cover Plcmnt	-	.006	-	.006	-	.006	-	.002	-	.002	-	.002	-	.0005	-	.0005	-	.0005
Wind Erosion	-	-	-	-	-	-	.312	.245	.312	.245	.312	.245	.204	.16	.204	.16	.204	.16
Total	5.04	3.60	4.72	3.60	4.72	3.61	1.50	.65	.94	.65	.94	.65	.83	.56	.55	.56	.55	.57
TOTAL COMBINED LF	8.64		8.32		8.33		2.15		1.59		1.59		1.39		1.11		1.12	

* Excavation
** Operation
\- not applicable

TABLE O-5

Mobile Source Emission Rates - Construction
(Off-Site Traffic)

Re-entrained road dust emissions from paved roads was assumed to be:

10 g/vkt vkt = vehicle km travelled

At 80 km/hr, TSP emission rate from each vehicle is:

0.22 g/s

Emission Rates (g/km) assumed for CO, NO_x and HC from vehicle exhaust are:

	CO	NO_x	HC
Trucks	2.6	7.4	1.2
Cars	6.6	0.74	0.52

APPENDIX P

VISIBILITY OF EVAPORATOR PLUME

P-1 INTRODUCTION

The purpose of this Appendix is to outline the methodology used in calculating the length of the visible steam plume which would be emitted from an effluent evaporator attached to the OWMC physical/chemical treatment plant.

P-2 METHODOLOGY

The analysis of visible plume lengths for the evaporator was based on the following major assumptions (Monenco, 1987):

- Stack height - 45 m
- Effluent consisting of steam saturated at 121°C, density 0.563 kg/m^3
- Steam flowrates - 25.9 t/h, 8.63 t/h

A Gaussian plume model was used to predict the dilution of the steam plume with ambient air. The plume is assumed to be no longer visible when the dilution at the plume centreline is:

$$\frac{se_{(o)} - se_{(a)}}{de_{(a)}}$$

where $se_{(o)}$ is the saturated vapour pressure at the source (taken as approximately 211 kPa)

$se_{(a)}$ is the saturated vapour pressure at ambient temperature in kPa, and

$de_{(a)}$ is the ambient moisture deficit in kPa

Plume visibility is essentially determined by the steam flowrate and four meteorological variables - wind speed, atmospheric stability, ambient temperature (dry bulb) and relative humidity. Use was made of available meteorological data from Hamilton (Mount Hope) airport. This consisted of joint wind speed and stability (Pasquill class) frequencies and temperature frequency distributions, with associated mean relative humidities (Environment Canada, 1983). Due to certain limitations in the available data, it was necessary to adopt a number of assumptions and approximations in the analysis (e.g., statistical independence of wind speed and temperature). However, these assumptions should not affect the results to any great extent.

P-3 REFERENCES

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APPENDIX Q

ODOUR THRESHOLDS FOR EMITTED CONTAMINANTS

Q-1 INTRODUCTION

This appendix contains odour thresholds for compounds potentially associated with the OWMC facility. Odour thresholds of compounds potentially associated with OWMC emissions are listed in Table Q-1 (Fazzalari, 1978, Leonardos et al, 1969, Punter, 1983).

Q-2 ODOUR THRESHOLD VALUES

Odour threshold values may be divided into two types, detection thresholds and recognition thresholds. A detection threshold value is the lowest concentration of an odorant at which the odour is detected. The recognition threshold value of an odour is the lowest concentration of an odorant at which the odour is perceived to be characteristic of the odorant.

Odour threshold values are normally determined from the response of a group of observers to varying concentrations of the test odorant. Usually, the concentration at which 50% of the group can detect or recognize the odour is the calculated odour detection or recognition threshold, although other similar calculation methods have also been used.

The odour threshold values presented in this appendix are a combination of detection and recognition thresholds, since detection thresholds are not available for some compounds. Generally, the lowest threshold found is the reported value, except in a few cases where other data were considered to be more reliable.

Q-3 REFERENCES

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TABLE Q-1

Odour Thresholds of Compounds
Potentially Associated with OWMC Emissions

Compound	Alternative Name	min $\mu g/m^3$	max $\mu g/m^3$	best $\mu g/m^3$
acenapthene		530	530	530
acetates	ethyl acetate	1700	24000	15000
acetone	2-propanone	9000	250000	9000
acrylonitrile		49000	49000	49000
benzene		5000	110000	16000
benzothiazole		470	470	470
butadiene	1,3-butadiene	1000	1000	1000
butylamine		250	250	250
carbon disulphide		360	690	360
carbon tetrachloride	tetrachloromethane	7400	930000	660000
chlorinated benzenes	chlorobenzene	1000	6300	1000
chlorinated ethylenes	dichloroethylene	4600	4600	4600
	trichloroethylene	120000	120000	120000
	perchloroethylene	34000	34000	34000
chloroform	trichloromethane	21000	690000	690000
chlorophenol	2-chlorophenol	0.17	11	0.20
	2,4-dichlorophenol	0.30	0.30	0.30
	2,4,6-trichlorophenol	0.10	0.10	0.10
cresol	m-cresol	4.7	4.7	4.7
dimethylamine		91	34000	91
ethanol		20000	170000	20000
formaldehyde	methanol	1300	1300	1300
hydrogen chloride		16000	16000	16000
hydrogen cyanide		28000	31000	28000
hydrogen sulphide		2	12	7
isocyanate	tolylene diisocyanate	16000	16000	16000
isopropyl amine		530	530	530
methyl amine		28	4300	28
methyl chloride		22000	22000	22000
methyl ethyl ketone	2-butanone	6200	31000	6200
methylene chloride		780000	780000	780000
methyl isobutyl ketone		430	2900	430
perchloroethylene		34000	34000	34000
phenols	phenol	160	250	160
pyridine		71	85	71
styrene		54	1400	210
sulphur dioxide		1300	1300	1300
toluene		670	27000	670
trichloroethylene		120000	120000	120000
trimethylamine		0.53	1.12	0.53

TABLE Q-1 (Contd.)

Odour Thresholds of Compounds
Potentially Associated with OWMC Emissions

Compound	Alternative Name	min $\mu g/m^3$	max $\mu g/m^3$	best $\mu g/m^3$
xylene	m-xylene	5000	5000	5000
	o-xylene	25000	25000	25000
	p-xylene	9600	9600	9600
	(not identified)	370	5000	370
anhydrides	acetic anhydride	620	620	620
alcohols	methanol	5900	140000	5900
	ethanol	20000	910000	20000
	isopropanol	8300	19000	8300
	n-butanol	380	51000	380
	2-butanol	450	5400	960
	isobutanol	2200	5700	2200
ethylene oxide		490000	490000	490000
freons	halocarbon 11	30000	30000	30000
	halocarbon 113	360000	360000	360000
hexane		34000	34000	34000
naphthalene		210	460	210
ethyl benzene		10000	10000	10000
trichlorophenol (2,4,6-)		0.140	0.140	0.140
ammonia		34000	34000	34000
aldehydes	methanal	1300	1300	1300
	ethanal	400	760	400
	propanal	23	23	23
	butanal	14	14	14
	isobutanal	150	150	150